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SEMI-ANNUAL REPORT

OCTOBER 1964-MARCH 1965

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NORTHEASTERN
FOREST EXPERIMENT STATION
Upper Darby, Pa.

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Periodic reports of Forest Insect and Disease Research are available upon request from the Forest Insect and Disease Laboratory, 135 Wood Street, West Haven, Conn. 06516.

FOREST ECONOMICS, RECREATION, AND WILDLIFE HABITAT RESEARCH

OFFICE OF THE DIVISION CHIEF

The Division Chief has found the past six months to be an exciting and interesting period, only slightly more than half of which was spent in the Upper Darby office. Since late January, Mr. Gilbert has been serving on a detail in the Washington Office as Director of the Division of Programs and Special Projects under Ham Pyles, the Deputy Chief of the Forest Service in charge of Programs and Legislation. Mr. Gilbert replaced George Burks in this position. Although Gilbert's official title is now "Acting Director" and he is officially in Washington on a "detail", it is very likely that he will continue in this position on a permanent basis once the necessary paper work has been completed. This new job is exciting for one as interested in Forest Service programs as he is. We all wish him well and expect that he will do well in this new position.

Prior to his detail in Washington, Gilbert had a busy autumn. He presented a talk at the Appalachian Technical Committee Meeting of the American Pulpwood Association; this was held in Tennessee. In this talk, he laid the ground work for extending the planned pulpwood production reports for the Northeastern States from New England and New York to the remainder of the Station territory. Shortly after taking the Recreation and Wildlife Habitat Management Research projects under his wing in the new division lineup, Gilbert was subjected to rigors of a GFI for both Recreation and Wildlife Habitat. This entailed trips to Warren in October and November. In early March, Gilbert met with State and industry officials in Maine to discuss (1) plans for a Forest Survey of that State and (2) a study in which he had participated from the start, the Southern Maine Growth Study.

Under the aegis of the Division Chief, the forestry attaché at the West German Embassy in Washington, Wolfgang Koehler spent two days in Upper Darby in February. During this time he met with the Director, the Regional Forester, and the members of the Forest Economics Research Staff, in addition to staying with the Gilberts. With the Economics Staff, Koehler discussed the problems of forest management and forest industry in West Germany and the present and prospective status of foreign trade in forest products between the United States and the Common Market countries. From these discussions, it appears that in spite of the fact that there is some reversion of agriculture land to forest lands in West Germany and that the forests of that country are underutilized from a physical standpoint, West Germany may still provide a substantial market for forest products exported from the United States and other countries. The place of the United States in this foreign trade will depend in large part on the actions of Canada and the Soviet Union, two major exporters of forest products to Europe.

RESOURCE ECONOMICS

The Economics of Government Forestry Programs

Research activity during the last six months within the project has been restricted largely to planning a major study of the dynamics of the timber economy in the Northeast.

Economic base studies for the comprehensive river basin studies were prepared and submitted to the Corps of Engineers for sub-area breakdowns in New England and to the Public Health Service for the Chesapeake Bay Drainage Area. In connection with the River Basin studies, Hagenstein attended meetings in Boston and Columbus, Manthy attended a meeting in Charlottesville, and both attended a meeting in Huntington. Neal Kingsley attended meetings in Buffalo in connection with the Genesee River Basin study.

Two thick publications were issued during the past six months. In addition to this, Hagenstein prepared two papers, one of which was presented to the Annual Meeting of the American Pulpwood Association in New York in February and the other before the Second Annual Governor's Forestry Conference in Lexington, Kentucky, also in February.

Project members were being actively trained during the past six months. Manthy took a ten-week speed-reading course at the Navy Yard in Philadelphia and another ten-week speed-reading course with the Evelyn Wood Institute in Philadelphia. The net result was an increase in the reading rate of some 250 words per minute to some 5,000 words per minute with no loss in comprehension. Hagenstein participated in a one-semester seminar at the Woodrow Wilson School of Public and International Affairs at Princeton University. This seminar, the Processes and Practices of Management, was taught by John Corson, a man who has had a great deal to do with government in the past 30 years and is well acquainted with the Forest Service and its problems. This was a very stimulating course to one interested in government and the things about government that make the wheels go around.

In addition to the above activities, project members variously attended the Annual Meeting of the American Pulpwood Association in New York, the Allegheny Section of the SAF at Pittsburgh, the Winter meeting of the New England Section of the SAF at Boston, and the final meeting of the Northeastern Regional Project, NEM-24, in New York.

Publications

Hagenstein, Perry R. Timber Industry Opportunities in Selected Areas of West Virginia. U. S. For. Serv. Research Paper NE-28, 1964. 72 pp.

Manthy, Robert S. and Lee M. James. Marketing Pulpwood in Selected Areas of the North Central Region, Mich. State Univ. Agr. Exp. Sta. Research Bulletin 6. 1964. 120 pp.

Submitted for Publication:

Hagenstein, Perry R. Decision Factors in Determining Pulp Mill Locations. Proceedings, Amer. Pulpwood Assoc. Annual Meeting, 1965.

Economics of Timber Growing

A manual of analytical procedures for evaluating reforestation and stand improvement projects on the National Forests has been a major concern during the last six months. This manuscript is now in its final stages of revision, and when published will provide the basis for economic analysis of intermediate silviculture throughout the National Forest system. We anticipate that the analyses based on it may have considerable impact on the management programs on many National Forests. The manuscript is being prepared jointly with the W.O. Division of Economics Research and W.O. Timber Management Division of NFA.

This period also saw the completion of several more studies dealing with white pine. The blister rust infection rate study was published, and field data for the region-wide pest control opportunities study have now been collected by our cooperators in F. S. Pest Control and the various state pest control agencies. Two more papers remain to be written in this area, one dealing with blister rust control profitability and another outlining the region-wide picture for white pine pest-control opportunities.

Last Fall we were fortunate enough to add J. Edwin Morse as the project's second scientist. "Ed" came to us from the George Washington National Forest, and brought with him a research project dealing with the evaluation of intermediate silvicultural practices in the oak-hickory type. Ed's undergraduate training was at Syracuse and he also holds a Master's degree from that institution, with concentration in forest economics. We know that Ed is going to be a real asset in the work of the project, and to us all.

Meetings:

Economic Outlook Meeting--Greater Philadelphia Chamber of Commerce--Philadelphia, Pa.

Allegheny Section, SAF--Pittsburgh, Pa.

Publications:

Marty, Robert. 1964. Analyzing Uncertain Timber Investments. U. S. Forest Serv. Res. Paper NE-23.

Marty, Robert. 1965. Low Average Blister-Rust Infection Rates May Mean High Control Costs. U. S. Forest Serv. Res. Note NE-28.

Marty, Robert. 1965. Timber Economics in a Nut Shell. Journal of Forestry.

Gould, E. M. Jr. and O'Reagan, W. G. 1965. Simulation, A Step Toward Better Forest Planning. Harvard Forest Papers, No. 14.

Submitted for Publication:

Marty, Robert. 1965. How Much Can You Afford to Spend Controlling Forest Insects? Proceedings: 13th Annual Forestry Symposium. Louisiana State University, Baton Rouge.

Marty, Robert. 1965. Mensurational Characteristics of Eastern White Pine. U.S. Forest Serv. Res. Paper NE-

FOREST SURVEY

Maryland Survey

The final run for the computer output data of the Maryland Resurvey was received from the Yale Computer in Upper Darby in early March. By the end of the month we had checked the data and multilithed 24 preliminary tables of forest area, timber volume, net annual growth, and timber cut for the State and five geographical sampling units. These tables, in advance of the State report, are for immediate use by land-use planners and other users. Similar tables for each county are being prepared and will be distributed in May. The report on the Timber Resources of Maryland will be available later in 1965.

A maximum effort of output data for required tables for State, geographic strata and County data was requested. This amounted to a paper output length of approximately one mile for one set of the complete output data! And we believe that the quality of this effort is quite comparable with the quantity so indicated.

This all is a result of the modified Survey program developed by the New Haven Biometrics Unit. Data was processed on the new machines at the Yale Computing Center--7094/7040 Direct Coupled System.

Pennsylvania Survey

Now that the data processing for Maryland has been completed, our staff has turned to the preparation of input data for the Pennsylvania processing. This will include our own survey plots and plots from the cooperative inventories on the Pennsylvania State Forest lands and the Allegheny National Forest. We hope that output data will be received during the summer. Preliminary tables will be prepared for immediate use and the State report will be prepared later in 1965.

Vermont Survey

The Forest Survey Field Staff has spent most of the winter doing the P.I. on the "leaf-less" photos in the state of Vermont. This has been completed, field plots selected and we are now ready for a field season in Vermont. Cooperative inventories are being planned on the Green Mountain National Forest and on the Vermont State Forest Lands.

A new manual of "Field Instructions for the Second Vermont Survey" has been prepared. This will be our first state in which we are utilizing the "standardized" version of field instructions as prepared for Forest Survey and the National Forests.

Crews will start field work in the State on April 26. This initial effort will consist of three crews and in June an additional 8 men will bring this total to seven crews. We plan to finish field work in November prior to the fall of too much snow! The State timber resource report will be published in 1966.

New York Survey

Planning meetings for the Resurvey of New York have been continued, but at a slow pace, as our staff efforts have largely been devoted to Vermont. During the remaining part of 1965 we plan to move along in order to arrange for air photos and do the necessary P.I. and office phase of Survey to prepare for field work in 1966. Current plans now are to start field work in the spring of 1966.

TIMBER MANAGEMENT AND FIRE RESEARCH

PERSONNEL

During December, Mrs. Geneva Horne left the TMR office due to her husband's transfer to Washington, D. C. Mrs. Joyce Summers has replaced Mrs. Horne as clerk-typist in the Division.

Visitors to the TMR office during the past 6 months from within the Station included: Miro Czapowskyj, Mike Hoyle, Si Little, Dave Marquis, Al Snow, and Dick Trimble. Bill Lloyd, from the local SCS office, spent some time in the Division discussing site, growth, and yield studies. And Frank Santamour, now with the Morris Arboretum (University of Pennsylvania), has visited us several times during the past few months.

FOREST FIRE RESEARCH

Fire Cause Study:

Summary of data resulting from intensive investigation of 171 randomly selected sample fires in Maine in 1964 gave the following results:

Cause of fire	Positively identified	Probably identified	Total	Comparative figures from regular fire reports
Debris burning	45 (51%)	14 (21%)	59 (38%)	180 (26%)
Smoking	4 (5%)	14 (21%)	18 (12%)	136 (20%)
Machine Use	10 (11%)	9 (14%)	19 (12%)	82 (12%)
Campfire	2 (2%)	--	2 (1%)	26 (4%)
Lightning	13 (15%)	3 (4%)	16 (11%)	133 (19%)
Incendiary	2 (2%)	7 (11%)	9 (6%)	51 (7%)
Miscellaneous	12 (14%)	19 (29%)	31 (20%)	87 (12%)
Total	88 (100%)	66 (100%)	154[1] (100%)	695 (100%)

1/ Cause could not be determined for 17 fires (10%).

The above data agree with expectations that fires originating from certain causes are more readily and positively identified than are fires resulting from other causes. Debris burning and lightning fires fall in the category of being easily identified.

Fires from smoking, machine use, incendiary, or miscellaneous causes are much more difficult to positively identify.

Of the 154 fires for which the cause was either positively or probably identified, there were 46, or 30 percent, for which no one individual could be considered responsible. These included lightning, railroad, and dump fires. For the remaining 70 percent, or the 108 fires that could be tied to individuals, the responsibility by sex, age, residence, occupation, and activity engaged in when fire started was shown to be as follows:

Sex: Basis--93 fires
Male--88%; Female--12%

Age: Basis--89 fires
Under 12--24%; 12 to 20--9%;
21 to 50--47%; Over 50--20%

Residence: Basis--86 fires
Out of State--3%;
Within State--97%;
Within town of fire location--85%

Occupation: Basis--82 fires
Students and children under 12--31%;
Farmers--16%; Woodsworkers--11%;
Service employees--7%;
Housewives--6%; Retired--6%;
Truckers--5%; Unskilled--5%;
Other (including commercial Fishermen, unemployed, disabled, managerial, law enforcement, skilled and semi-skilled)--13%

Activity engaged in: Basis--92 fires
Debris burning--49%; Children playing--22%; cutting, yarding, and hauling wood--11%; Fishing--4%;
Parking in secluded areas--2%;
Miscellaneous--12%.

These items of information should be of value in tailoring a forest fire prevention program to the State's needs.

DIVISION ACTIVITIES

In February, Leak gave a talk at the Region 7 Orientation Meeting on the Station's organization and programs. The audience consisted primarily of new employees in Region, both foresters and engineers.

A short meeting of the cooperators in the white pine growth study was held in March at Boston, Massachusetts--between sessions of the New England Section Meeting. Plans are underway to make a preliminary analysis of the 3-year growth data from the study sometime this fall.

An informal meeting was recently held in the TMR office to discuss a proposed financial evaluation of evenaged vs. unevenaged management of hardwood stands. Doolittle, Marty, Trimble, and Leak participated. Since several public agencies are considering a change from unevenaged to evenaged methods, we feel that some guidelines should be prepared on the advantages and disadvantages--both financial and otherwise--of each method under specified conditions of forest type, management intensity, and market opportunity. As a start, Dick Trimble will compile some management information for Appalachian hardwood stands to use as a basis for economic analysis.

In cooperation with Region 7, the Station is participating in the replanning of fire control needs for the period 1965-69. The Station's share of the work is being coordinated by the TMR office. Fire conditions on each experimental forest have been or are being reanalyzed by the project leader and his staff. The analytical information for experimental forests on National Forest land will be forwarded to the local National Forest personnel to assist them in planning their needs for fire funds, equipment, and manpower.

The use of linear programming for regulating timber yields seems to be moving beyond the drawing-board stage. Timber management people in the Pennsylvania Department of Forests and Waters have asked us to try a linear programming analysis for one of the State Forest working circles. The objective of the analysis will be to develop a cutting schedule that will efficiently lead toward a balanced age distribution while maintaining a given minimum allowable cut. The Biometrics Unit at New Haven has found a computer program for linear programming problems. Providing that we can figure out how to use it, this computer program should save considerable time on the computations.

In late March, Doolittle and Leak went to Orono, Maine for a meeting on the Maine Wood Density Study with representatives from the Orono project, industry, the Forest Products Lab, and the University of Maine. Procedures for analyzing the data from this study were discussed, and tentative plans were made for publishing the results.

MEETINGS

October 19-20: Advisory Committee Meeting, Parsons, West Virginia--Doolittle

October 19-23: Region-Station Watershed Workshop, West Thornton, New Hampshire--Leak

October 26-27: G.F.I., Region 7 (TM), Laconia, N.H.--Doolittle

January 6-8: Northeastern Weed Control Conference, New York, N.Y.--McQuilkin

January 14-15: Region-Station Watershed Conference, Upper Darby, Pa.--Doolittle, Leak

January 19-24: Middle Management Institute and W.O. Orientation, Washington, D. C.--Leak

February 11-12: SAF Allegheny Section Meeting, Pittsburgh, Pa.--Doolittle

March 11-12: SAF New England Section Meeting, Boston, Mass.--Doolittle, Leak

PROGRESS REPORT
Forest Utilization Research
January - March 31, 1965

Introduction

An open winter in the Northeast has contributed to one of the best seasons in a long time for the entire processing industry. There has been almost no time up until the date of this report when snow conditions prevented a continuous supply of both pulpwood and sawlogs to the mills. Reports indicate that many mills which ordinarily have had closed periods during normal winters have been able to stay in production this year. In some areas where heavy early season cutting was done in preparation for normal winter activities there is an actual surplus of logs which may lead to storage problems if they are still on hand when the warm weather develops.

Almost the entire hardwood manufacturing industry has retained the past years impetus into the first part of this calendar year. For the first time in many years there is an acute shortage of hardwood dimension stock in the Northeast. This is indicative of the demand for this type of material. In general terms, all of the industries using wood as raw material seem to be off to a good start for 1965.

Project FS-NE 3601--Improvement in Timber Utilization Technology in the Northeast

The analysis of the hardwood chip storage data continues. Indications from the pulping data show vast color changes have occurred very rapidly in the stored chips. Even after bleaching those chips stored over a long period of time do not reach the initial brightness obtainable from fresh wood.

Although no specific projects are proposed at this time an effort is being made to correlate the wood quality work done in the area with the manufacture of hardwood products. It is proposed that such wood quality work will be tied in directly with the manufacturing process at some time in the near future.

The field work for the scarlet oak mill scale study and red maple log grade study conducted in October, 1964 was completed with the grading of the air dried lumber. Project personnel have been assisting the Northern Softwood Log Grade project in editing and compiling log grade data for analyses. The revised edition of the Hardwood Log Grading Guide is now at the printers and will be ready for distribution in early April.

Project FS-NE 3101 Northern Softwood Log Grade Project

White Pine Log Grade Studies:--Data from all studies has been re-edited including application of several new modified grading systems prior to final punching on IBM cards. Arrangements have been made with Region 7 facilities to do the card punching prior to processing by the biometrics unit at New Haven, Connecticut.

Red and Jack Pine Studies:--Project leader Ostrander and Ed Clarke of the Washington Office met with Timber Management personnel of Region 9 and Lake States Forest Experiment Station at Milwaukee early in January for the purpose of working out details conserning the analysis of the Chippewa National Forest Red and Jack Pine Log Grade study data. Region 9 has agreed to make whatever preliminary analyses of the Chippewa data necessary to satisfy immediate needs. Several other studies of these species are planned before final analysis is done.

Meanwhile, project personnel with assistance from Northeastern Forest Experiment Station has completed editing of field data (diagrams, lumber tallies) from the Chippewa and Red Lake Studies which are now ready for transfer to cards. Results of limited preliminary examination of the data indicate that the recently developed Inland Douglas Fir log grade specifications (with slight modifications) may do an adequate job of lumber grade and value segregation for red and jack pine sawlogs. If they prove to be adequate they will be proposed as a standard for red and jack pine.

General

Brisbin attended the two day Industrial Adhesives Institute at the University of Wisconsin. Ostrander and Brisbin helped plan and lay out demonstration material for the White Pine Log Grading Demonstration at Kenne, New Hampshire. Jorgensen continues to spend considerable time on the 1965 National Forest Products Society meeting to be held in New York City. Meetings of the Regional Log Grade Committee, Equipment Advisory Board and several other committees were attended. He gave the initial lecture on wood technology at the Garden State Lumber and Pulp school and attended the Northeastern FPRS Board meeting and the New England Lumber Manufacturers' Association annual meeting.

BURLINGTON UNIT

Semi-Annual Report, October 1964-March 1965

GENERAL

Personnel

Burlington continues to increase in number of personnel. Russ Keil joined the staff in September as a forestry aid. He and his wife Lynn hail from Syracuse, New York. Bart Blum joined the staff in October having transferred from the Laconia Unit. Carter Gibbs arrived in February having transferred from Parsons via Syracuse where he has completed his residence requirements for the Ph.D. degree. Myrtle Sanborn joined the staff in March to assist in a clerk-typist capacity. John Irwin, a forestry student at the University of Vermont, is on a temporary appointment to assist in field work in maple sugaring and nursery operations. Tom Perrier, our former administrative assistant, has transferred to the Green Mountain National Forest Unit at Rutland, Vermont where he will serve in a similar capacity.

The stork visited our unit twice during the month of March. Bart and Marge Blum now have a new decoy collector and duck hunter with the arrival of Jeffrey Lewis on March 22. Russ and Lynn Keil have an additional passenger on their dog sled with the adoption of David John on March 15.

The annual stag-rabbit stew supper was successfully held in February. As a result of the lack of successful hunters and hunting, chicken was substituted for a portion of the purchased rabbits in the stew.

Meetings (Travelings)

Al Snow visited several maple sugar producers in Ohio, Michigan, and Wisconsin during the month of February. He participated in programs for producers at Burton, Ohio and East Lansing, Michigan.

Carter Gibbs, Al Snow, and Mel Koelling visited Lin Lesure in Ashfield, Massachusetts; Lloyd Sipple in Bainbridge, New York; and Bob Morrow at Cornell during March to study field methods of plastic tubing use and sap production research.

Bart Blue, Mel Koelling, Carter Gibbs, and Ray Foulds from the University of Vermont visited Bill Nicholson's sugarbush at St. Emile, Quebec during the latter part of March. Tubing installations and sugarbush silvicultural management practices were observed.

Bill Gabriel has been traveling extensively through New York and New England in connection with research activities in the superior sugar maple selection program. He has served as the principal speaker at a number of state and county sugar producer meetings.

Visitors

Visitors to Burlington during the past six months included working visits by Warren Doolittle, Bob Bain, and Les Henderson from Upper Darby. Tom Nelson from the Washington office was here in November.

Publications

Published

Curtis, R. O. and B. W. Post
1964. BASAL AREA, VOLUME, AND DIAMETER RELATED TO SITE INDEX AND AGE IN UNMANAGED EVEN-AGED NORTHERN HARDWOODS IN THE GREEN MOUNTAINS. Journal of Forestry, Vol. 62(12): 864-870, 1964.

Submitted

Gabriel, W. J.
ONSET AND DURATION OF RECEPTIVITY IN SUGAR MAPLE FLOWERS. Forest Science, Fall, 1964.

TIMBER RELATED PRODUCTS

Improvement of Sugar Maple with Respect to Sap Production

Since this portion of the sugar maple research project is relatively new, much of the work thus far has involved orientation and familiarization of personnel with operating procedures and problems in the maple sugar industry. In addition, familiarization and reviewing of available literature concerning pertinent research efforts has also been a continuing investigation. However, some studies of our own have been initiated.

Off-season tapping of sugar maple. This study, initiated in November is designed to determine the influence of aspect and cardinal tapping direction on sugar production from sugar maple trees tapped in the off-season. This portion of the study along with the effects of fall tapping on normal spring sugar production from these same trees will also be evaluated during the spring season.

Effects of bole temperature on sap flow. This study, established in February is designed to determine the effects of a black plastic wrapping on raising bole temperatures through increased absorption of solar radiation. It is thought this temperature increase may in turn initiate sap flow earlier or prolong a given flow period.

Other studies--An exploratory study of the effect of two chemical solutions, sulphuric acid and sodium hydroxide, on sap flow from sugar maple trees has also been established. Three different treatments representing solution concentration differences have been applied.

Another exploratory study investigating spout color and its effect on sap flow has also been established.

Sugar production records are also being recorded from approximately 250 trees. These "calibrated trees" will be used in future research experiments.

Rangewide provenance study in sugar maple. Much time during the late fall and winter months was spent developing a working plan, collecting and processing seed and planning other outplantings with cooperators in Michigan, Quebec, Maine, and West Virginia.

Seed from thirty-two sources was received from areas ranging from Oklahoma to New Brunswick. Data on seed size and percent of filled fruit have been collected but have not yet been analyzed.

Seed is being germinated for the nursery phase which will start this spring and run for three years. Following this a field outplanting will be established using the same stock as in the nursery phase.

Survey and selection for sugar maple. Results for the 1965 season are not yet complete. However, the survey portion of the study was completed last year in Massachusetts, and will be possibly completed in Vermont this year. Pennsylvania was welcomed into the program this year and a fourfold increase in participation occurred in New York State. New Hampshire has purchased instruments for five more foresters which increases the fieldmen in this state from two to seven.

Birch arboretum. Seed was received last winter of two new species not yet in our arboretum. These are presently under stratification and if germination occurs, the plants will be outplanted in the arboretum next year, following a year in the nursery. This will bring our arboretum up to 17 different varieties and species of birch which reach a minimum height of 40 feet in their native habitat.

Relationship of black maple and sugar maple. Rather striking differences in external morphology between pure sugar maple and black maple have been documented. Reciprocal crosses have been made between good black and sugar maple for purposes of studying the progenies; however, relatively low seed sets will require that another series of crosses between these species be scheduled.

SEEDING AND PLANTING OF NORTHERN HARDWOODS

Seed storage. After three winters of storage the third set of germination tests has been started for sugar maple seeds placed in storage in November 1962. Seeds have been stored successfully over two winters at certain moisture and temperature combinations (See Semi-Annual Report April-September 1964). The trend thus far indicates that a storage temperature of -10° C. and a moisture content of 10 percent will probably be the best storage combination.

Cultural practices and protection. Last fall a study was started to determine the effects of cultural practice and protection from animal damage on survival and early growth of field planted 2-0 sugar maple seedlings. Comparisons of survival and growth will be made on plots which have had no ground preparation, plots which have been cultivated and plots which have been cultivated and covered with black plastic mulch. The effects of two protective measures, wire screens around seedlings, and a repellent, (known commercially as Z.I.P.) are being compared with no protection.

The seedlings were planted in an abandoned pasture on the Rochester Ranger District of the Green Mountain National Forest, about 2½ miles northwest of Granville, Vermont.

Vegetative propagation. Efforts are being continued to determine the most favorable overwintering storage procedure for rooted sugar maple twig cuttings. Approximately 1200 rooted cuttings were obtained from our establishment program conducted during the summer of 1964. This represented a rooting percentage of approximately 42 percent. Abnormally cold temperatures during the months of August and September apparently contributed to this low level of successful rooting. Four overwintering procedures, i.e., cold frame storage, refrigerator storage at 33° F., and direct mulched outplanting in the nursery are currently being followed.

A new study designed to determine the most favorable collection date of twig cuttings as indicated by increased rooting and overwintering success levels is currently underway. Twig cuttings from six mature sugar maple trees are and will continue to be collected twice-monthly during the period February 1, through July 19, 1965. These cuttings are being subjected to controlled greenhouse environmental conditions designed to induce and promote maximum root formation.

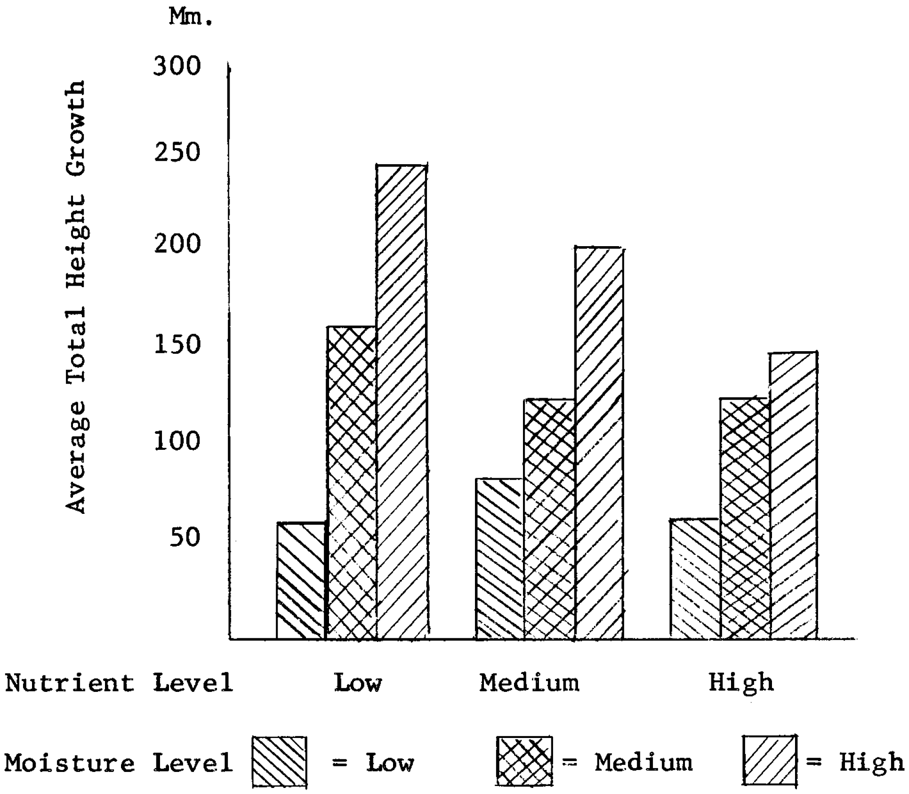
Direct seeding vs planting. A study has been initiated to compare the performances of sugar maple seedlings established through direct seeding and by planting 1-0 and 2-0 nursery stock. All seeds were sown last fall, those for direct seeding being sown in the field and for the 1-0 and 2-0 stock in the nursery. The 1-0 stock will be planted in the fall of 1965 and the 2-0 stock in the fall of 1966.

This site for this study is an abandoned pasture on the Green Mountain National Forest near Granville, Vermont.

Seed collection data. A study was started in the fall of 1964 to determine the effect of date of collection on the germination of sugar maple seeds. Weekly seed collections from three trees were made starting in August 1964 and continuing into October until seeds were completely shed. After collection the seeds were slowly air dried until the moisture content was 15 percent and then stored at 35° F. until stratified.

Nutrient and moisture effects on growth. The first season of growth for our potted sugar maple seedlings ended successfully and one-third of the 486 seedlings were harvested for sugar and starch analyses. The fresh weight and final height and diameter measurements were obtained at the time of harvest. The sugar analysis, which proved to be a very time consuming task, has been completed for one-half of them representing all treatments in all replications.

Examination of the height growth data showed that the relationships shown in the last semi-annual report, for one period of growth, held for the entire season as shown in the following graph.


Mm.
300
250
200
150
100
50
Average Total Height Growth
Nutrient Level
Low
Medium
High
Moisture Level
= Low
= Medium
= High

DURHAM UNIT

Semi-Annual Report, October 1964-March 1965

Most of the winter months have been devoted to compilation and analysis of data and literature review needed for several publications.

Last fall we arranged with State Forester Messeck to plant two seedbeds at the State Nursery in Gerrish; Mr. C. Ingersoll Arnold, in charge of the nursery, provided excellent cooperation on seed-bed preparation and labor incidental to planting. This nursery seeding included seedlots of a large number of Japanese larch provenances originally obtained from Dr. Langner (Schmalenbeck, Germany) through the late Dr. Klaehn, and a considerable number of exotic conifers. We had been carrying this seed in storage for a number of years; since we were first advised that the Project would be moved out of the Philadelphia area.

Dr. Schreiner has given two illustrated lectures at the University during this period; one to the freshman forestry class on opportunities in the broad field of forest research, and a lecture on forest tree improvement to the Forestry Club. The Genetics Project's association with the University has begun to pay off in the opportunity to meet at intervals with the "Genetics Group" and to consult on an informal basis with faculty members working on plant and animal breeding and in other related fields of plant science and in statistics. The weekly genetics seminar on heritability in plants and animals has provided information of particular pertinence to the evaluation of our progeny and clonal tests.

Visitors. Late last fall we had three visitors: Dr. Osamu Chiba, Chief, Laboratory of Forest Pathology, Government Forest Experiment Station, Tokyo, Japan; Dr. Hans M. Heijbroek, Geneticist, Forest Experiment Station, Baarn, Holland; and Dr. Carin Ehrenberg, Department of Forest Genetics, The Royal College of Forestry, Stockholm, Sweden. Dr. Chiba is particularly interested in breeding for disease resistance in poplars; Dr. Heijbroek in resistance of elm to Dutch elm disease and in breeding for disease resistance in general. Dr. Ehrenberg's interests are in the general field of forest tree improvement, particularly of conifers. She was very interested in our white pine research.

Dr. Andrea Giordano of the Instituto Nazionale per Piante da Legno Giacomo Piccarolo, Torino, Italy, was a visitor in early March. His Institute is particularly interested in introducing or developing rapid-growing conifers for northern Italy. Eastern white pine is one of their best prospects; within the past 100 years it has become naturalized in several areas of the eastern Po Valley.

Changes. In December, the Hopkins Memorial Experimental Forest at Williamstown, Massachusetts, was placed on a maintenance basis. With the exception of the workshop, all buildings on the headquarters site were vacated and leased to Williams College for their occupancy and use.

The administrative and research responsibilities for the forest were than assigned to the Durham Unit. No longer is a resident staff located at Williamstown. Genetic studies on the forest will be continued until completion.

Personnel. Since vacating Williamstown, Frank Cunningham transferred to Durham. He thinks he will soon acclimate himself to the Durham atmosphere.

Dick and Julie Peterson decided to stay in Williamstown to complete and enjoy their new home. Dick is now engaged in private forestry work in the Williamstown area. We hate to lose them and we wish them every success in their new endeavors.

There have been two recent publications on research at the Hopkins Experimental Forest.

Simazine no substitute for cultivation in hybrid poplar plantations. Tree Planters' Notes 70: 21-26. 1965.

Some factors that may influence germination, survival, and growth of sugar maple. Presented at Symposium on Direct Seeding in the Northeast at Amherst, Massachusetts, 1964.

FOREST PRODUCTS MARKETING LABORATORY

Semi-Annual Report, October 1964-March 1965

The Forest Products Marketing staff has been in the new headquarters building at Princeton for well over a year and finds it measures up well to our expectations. At the end of March the staff included 11 scientists, 3 technicians, and 11 clerical, administrative, and custodial employees. One additional scientist will be added soon.

Our Methods Testing Plant is completed and ready for occupancy except for surfacing of the road and parking areas. Bids will be let for this job sometime this spring. Plans are now also being prepared for the construction of an extension to the garage-shop building for storage space at the headquarters site.

It looks like we are headed for an expansion. The Forest Service appropriation bill for the coming fiscal year carries a budget increase that will enable us to double the present staff. The Appalachian Regional Development Bill also carries a proposal for an allotment of $220,000 for the initiation of a Forest Utilization Project at Princeton. Sixteen people would be employed in this new project.

At the end of March 1965, the FPML had a total of 18 formal approved studies underway, 6 manuscripts submitted for publication, and another 8 manuscripts in preparation for publication. Five articles were published during the past six months. A brief review of some of the more important studies and lines of research underway follows.

MARKETING PRIMARY FOREST PRODUCTS

Log grading costs. It is apparent that the producers, buyers, and users of hardwood sawlogs are seriously handicapped by a lack of information about the quality of logs they produce or buy. The Forest Service has developed and proven a very dependable system of grading hardwood logs that can be used to establish the quality and value of hardwood logs. Unfortunately, few people use this system or any other log-grading system. They give the added cost of grading as the principal reason for neglecting this important marketing tool.

Tom Church has completed a study that shows that grading hardwood sawlogs is far less costly than most people realize. He found that grading logs at the time they are scaled--a normal procedure--costs less than 20 cents per thousand board feet under most conditions. This is a very low cost when considering that just scaling costs about 80 cents per thousand board feet, using the Forest Service scaling practices. Church is completing an analysis of the variation in cost for grading and/or scaling logs of different sizes, species, and at different locations--woods, woods landing, mill yard, and sawmill deck.

Forest cooperatives. Gil Dempsey is finishing up his analysis of Forest Cooperatives, and has presented a preliminary report on this subject before the U.S.D.A. committee on forest cooperatives. He plans to conclude work on this subject as soon as the information is summarized in a manuscript for publication.

Railway tie markets. Tom Church is well along on an analysis of the railway tie market. At the present time there is an exceptionally strong demand for hardwood crossties: a demand that the crosstie producers have been unable to meet. This imbalance between supply and demand will continue through 1965, and may last for several more years.

The current strong market for ties should provide an economic stimulant for the small crosstie producer, but so far it has had little effect. The main cause is that during the past decade more than 75 percent of the crosstie producers quit business. These were the little businessmen: the loggers, the truckers, and the small sawmill operators. There were many reasons for these business closures, but the primary cause was the low demand for ties because of deferred maintenance on many of the Nation's railroads.

To combat current low production rates, railroads have increased their tie prices. But even this inducement has failed to generate a significant increase in the production. And, as a result, there is insufficient productive capacity in terms of both labor and equipment to meet the market demand for railway ties.

The FPML is now studying all the principal factors which affect nationwide crosstie markets. For instance, we are studying production problems associated with timber acquisition, logging, and sawmilling; we are evaluating economic problems such as financing for small producers, investment in stored ties, and resistance to price increases; we are investigating technical problems including chemicals and mechanical tie deterioration, species preferences, and tie serviceability; and, of course, we are studying marketing problems, which include fluctuating demand and competition from other materials. When all this information has been assembled and evaluated, we should be able to recommend specific action to relieve the current under supply of wood ties.

MARKETING PRIMARY WOOD PRODUCT MANUFACTURES

Lumber preferences. Ray Sarles has completed the collection of field data to determine lumber preferences by the flooring, furniture, and pallet industries. The survey revealed that two-thirds of the flooring manufacturers share the opinion that they would save operational time and money if all lumber shipments met their preferred specifications. These firms feel that using lumber that met their specifications would result in lower handling costs, savings in labor costs, reduced lumber waste, and increased flooring yields. More than one-half of the firms indicated they would be willing to pay from $2.00 to as much as $8.00 more per MBF for hardwood lumber manufactured and delivered according to their preferred specifications.

Lumber specifications that appear to be most desired by the majority of flooring manufacturers called for rough, red oak lumber of Number 2 and 3A Common grades. Lumber should be uniform in dimension and not less than 1 1/8 inches thick if green and full 4/4 inch thick if air-dry. Air-dry material should have 20 to 25 percent moisture content. Length may be random but widths of 3, 6, 9, and 12 inches are preferred.

The majority of buyers prefer lumber that is separated, packaged, and shipped by species and lengths; they prefer shipments by trucks or chaincars suitable for forklift unloading. Prompt delivery in accordance with contract schedules is also of great importance to the purchasers.

Results of the study were presented to the last meeting of the Hardwood Action Council and are now being utilized by the Southern Hardwood Lumber Manufacturers Association and Southern Furniture Manufacturers Association. A series of manuscripts are being prepared for publication in trade journals and as a Station research paper.

Evaluation of grade 3 logs. A study was conducted by the Laboratory during the past year to determine the minimum size of Grade 3 hardwood sawlogs that can be sawed profitably at efficient sawmills. Production rates, production costs, and product values were determined for Grade 3 red oak, sugar maple, and yellow-poplar logs of different diameters at the three major types of sawmills in the region--circular, band, and band with resaw equipment.

Preliminary results, based on current sawlog values, indicate that red oak and sugar maple logs 12 inches and larger in diameter can be processed profitably at the better sawmills; and that Factory Grade 3 yellow-poplar 11 inches and larger in diameter are profitable. Similar data is being gathered for black cherry and beech sawlogs. The final published analysis will provide information on the rate of return from sawing Grade 3 logs in each diameter class at each of the three types of sawmill units.

Seasoning degrade. Cuppett has prepared a research note describing a simple system for determining air seasoning losses and their causes at sawmills and concentration yards. A similar article for determining in-plant drying losses has been prepared for delivery at the annual meeting of the F.P.R.S. in New York this coming June.

These "how-to-do-it" publications resulted from the study of the air-seasoning losses as they affect hardwood lumber market value in the Appalachian area. The study of air-drying practices in the Appalachian area involved dual-grading of 329 thousand board feet of air-dry oak and poplar lumber at 17 sawmills and concentration yards in five central Appalachian states. Results of the study indicate that careful application of presently known air-drying practices will result in well-dried lumber with little seasoning degrade. A potential saving of at least $25 million in air-seasoning losses in the Appalachian area is possible.

The study shows that seasoning degrade in yellow-poplar was insignificant. But average degrade loss in air-drying red oak in the Appalachian hardwood region was determined to average more than $10 per thousand board feet. The degrade losses in drying red oak--the major type of lumber produced in West Virginia and some other Appalachian states--ranged from a few cents to more than $100 per thousand board feet.

Seasoning costs. Construction of the forced-air dryer discussed in previous reports was started late in March at the FPML. The dryer will be used to determine the costs and other elements of forced-air drying in relation to their effect on markets for hardwood lumber. Analyses of air-drying and kiln-drying costs in the hardwood areas will also be carried out during the coming year by Alex Cole of the FPML staff. It appears that seasoning costs, degrade losses, and related factors involved in lumber seasoning comprise one of the most critical segments of lumber production--and probably offers one of the best opportunities to reduce costs and improve market values of this product.

The study of forced air drying of hardwood lumber will utilize a dryer in which we have made every effort to include all of the best and most up-to-date information on dryer design and operation. Data will be collected on costs, degrade, and other factors affecting the market value and utility of lumber seasoned in a forced-air dryer.

Logging and sawmilling costs. It is generally agreed that logging and sawmilling costs are up. But, we need to know how much and for what items of production these increases have occurred. With this information, it is then possible to determine the best opportunities or the need to effect production economies. Ray Sarles of the FPML staff accordingly conducted an analysis of 27 of the principal logging and sawmilling production cost factors. He found that prices for 23 of the selected items have increased from 3 to 170 percent over the past decade (1954-1964). The other four items decreased from 1 to 24 percent over the same period.

The analysis shows that total capital expenditures to purchase equipment necessary for a typical small to medium-sized logging or sawmilling operation have increased 45 to 50 percent over the last 10-year period. It is apparent, however, that cost increases for some items of equipment and supplies are at least partially offset by corresponding increases in productive capacity and service life, or require less maintenance and repair. The cost data are being made available to the lumber industry through publication in a leading trade journal. They will also form the basis for further research aimed at determining measures to reduce production costs.

George Niskala is also well along on a study of the economics and markets involved in the sawing of heavy dimension, blocking, etc. from the lower quality portions of hardwood sawlogs. Preliminary results indicate mill operators can earn an added $4.00 to $6.00 per thousand board feet with this practice.

SECONDARY WOOD PRODUCT MANUFACTURES

Hardwood flooring. Collection of data for a large-scale study of the comparative cost and ease of maintenance for residential floors of all types is nearing completion. Dave Martens and Leonard Koenick are collecting sample data for this study in nine large metropolitan areas from New York to Los Angeles.

Data for Boston, the first area sampled, revealed some interesting results: the data shows that the Boston housewives covered in the survey spend about one-fourth less time caring for hardwood strip flooring than for an equal area of wall-to-wall carpeting, one of hardwood flooring's leading competitors. On an annual basis, the difference in day-to-day care of an average 12- x 18-foot living room would amount to over 12 hours advantage in favor of wood.

The Boston data also indicated that household maintenance of oak strip flooring required about one-half the expenditure for expendable cleaning materials such as wax, cleaner, shampoo, and similar items as for wall-to-wall carpeting. In addition, the cost of professional services for commercial carpet cleaning was three times greater for wall-to-wall carpeting than the cost of similar services, such as sanding and refinishing, for oak strip flooring.

Total maintenance costs for expendable materials used by the housewife for oak strip flooring, plus professional care, amounted to only 40 percent of the cost reported for wall-to-wall carpeting. This difference in annual or long-term costs is even more dramatic when one realizes that due to the difference in wear life of the two materials, carpeting is usually replaced at least three times as often as oak strip flooring. A summary of the Boston results was published in the January issue of Flooring magazine.

Jim Micklewright has completed the collection of data on the factors affecting the use of hardwood flooring in on-slab residential construction. This study also included the collection of data from builders and home owners in a number of large residential areas as far west as Houston, Texas. The initial manuscript from this study will be ready by early summer.

Pallet markets. John Lucas has completed the problem analysis of the wood pallet industry and is now preparing a large-scale market service test of wood pallets of different specifications. This study will, in part, fill the great need of pallet producers and pallet users for information on the type of pallet best suited for specific uses.

Tony Carlson has completed the collection of data for a study of the pallet market in the steel industry. Longwood presented a paper on the problems of the pallet industry and research results in this field at the recent meeting of the National Wood Pallet Manufacturers Association in Palm Springs, California.

Decorative wood paneling. Tony Carlson, with help from most of the FPML staff, prepared a report at the request of the Forest Products Lab on the market potentials of a proposed new decorative panel made of low grade hardwoods. Unfortunately, we had to conclude that the product would be a poor market risk and did not warrant further developmental work.

RECREATION RESEARCH PROJECT

Serendipity with a reverse twist occurs when those "best laid plans" turn out even better than expected. Last summer, 422 randomly selected campers were interviewed at length concerning their leisure interests and limitations to their outdoor recreational participation. Twenty-one weeks later, this same "panel" of campers received the first of five annual re-surveys by mail. It was expected that non-response might run as high as 40-percent. However, with the earlier interviews to draw from, it would be possible to make some critical comparisons between those who did, and those who did not, respond to the mail survey.

Surprisingly, response to the mail survey ran to 93-percent, and there weren't enough non-respondents left to evaluate. As near as we can tell, from the basic field interviews, panel non-respondents are no more, and no less, involved in the out-of-doors than are their more communicative counterparts. Also, there are no apparent relationships between non-response and the origin of one's outdoor involvement; or between non-response and camping trip satisfaction at the time of the interview. Residential mobility is not significantly different between respondents and non-respondents.

By way of comparison, a first-wave response rate of 93-percent to a mail panel survey, is as high, or higher, than that which is commonly expected from personal interview panels.

We have examined non-response according to the location (campground) of the original interview, and sex of the non-respondent, for each interviewer. None of these three factors, or their interactions, appear to be significantly related to panel non-response.

Table 1. Distribution of panel non-response according to campground sampled, sex of panelist, and interviewer

Campground:	Interviewer #1 Males	Interviewer #1 Females	Interviewer #2 Males	Interviewer #2 Females	TOTALS
Baxter State Park	1	2	2	2	7
Dolly Copp Campground	4	1	1	1	7
Nickerson State Park	2	4	2	3	11
Rocky Neck State Park	2	0	0	3	5
Sub-Total	9	7	5	9	30
TOTAL	16		14		30

The method by which this high rate of return was achieved was in no way unusual. Interviewees were asked, in the field, if they would care to participate in an annual re-survey (at the close of the interview). All but two readily agreed. The mail questionnaire, accompanied by a personal appeal from the Station Director, included an offer of a copy of the final published study results. Most of the panelists wanted a copy, however this is probably not sufficient incentive in itself to guarantee response. The most significant factor is probably the use of reminder mailings at 20-day intervals following the first mailing.

The rate of return for each mailing period is given below.

Table 2. Wave I (1965) returns to the panel survey of New England Campers, by 20-day mailing periods

	Period	Return Rate	%	Cum. %
First Mailing	Jan. 15 - Feb. 9	286/421	68	68
First Reminder	Feb. 5 - Mar. 2	79/134	59	87
Second Reminder	Feb. 26 - Mar. 23	16/65	25	91
Final Reminder	Mar. 19 - Present	10/39	26	93

Many panelists would undoubtedly have sent in their questionnaires after February 5th, even if no reminders had been mailed. However, examination of response curves indicates that response would probably have peaked between 80 and 85-percent. The reminders therefore increased total response by about 10-percent.

Further analysis of this panel has been set aside in order to devote full time to a more complete evaluation of private campground visitors in New Hampshire.

The installation of card sorting and counting equipment has allowed us to begin an exhaustive study of these campers. When complete, this analysis will run to about seven times the machine time involved in preparing last Fall's private campground report.

Some early results, relating to factors affecting frequency of camper participation look promising. Frequency of camping is affected by whether or not a camper belongs to a camping organization. Fifty-nine percent of association members camp more than four times each year; while only 27 percent of non-members camp this frequently. Camper motivation also exerts strong influence upon both camping frequency, and organization membership. Perhaps the most significant influence is that of the three-way interaction of camper motivation, association membership, and camper preference for public versus private developments. The first two of these effects are illustrated in the following table.

Table 3. Percent of camper motivation groups who are members of one or more camping associations, by camping frequency classes

Camping Frequency	Percent who are Association Members				
	Social	Economic	Travel	Nature	Other
One trip per year	27	14	25	20	24
Two - four trips per year	45	22	35	18	29
Over four trips per year	74	54	48	52	50

Other activities of the past six months include the completion of a cooperative recreation-enumeration study with the State of New Hampshire, using traffic counters to estimate the volume of several recreation activities; a drafted revision of the line project description; and some preliminary evaluations of a market structure orientation as a framework for regional recreation research. The latter was presented to the Forest Resources Seminar at Penn State in March and was apparently well received in spite of being preceded by Walt Hopkins' spectacular slide presentation of recreation research activities across the country.

There have been no changes in project personnel during the past six months.

In December, the recreation project was host to Walt Hopkins for two days during a general research inspection. And, in March we enjoyed a two-day skull-session with the recreation scientists from the Central States Station, Dwight McCurdy and Ray Mischon.

Plans for new studies include the establishment of a second New England camper panel--this time of private campground visitors; and a study of recreational land use, both public and private, within the urban fringe.

TIMBER MANAGEMENT RESEARCH

Last summer, Huntzinger tested three herbicides for weed control around black cherry seedlings planted in an old field. Amizine at 4 pounds per acre, Dowpon at 4 pounds per acre, and Ansar at 15 pounds per acre, were applied either before or after transplanting the 1-year old seedlings, and either in spring alone or in both spring and summer.

Only amizine applied before transplanting and again in summer, other than hand weeding, reduced the ground cover from spring to fall; the increase in ground cover was less for several treatments than it was on control plots. Dowpon gave the best control of grasses, but this did not stimulate height growth much. Except for hand-weeded seedlings best average height growths were made by seedlings on plots treated with ansar in spring and summer and amizine in spring and summer, both applied after transplanting.

Volume computations were made for the 37 plantations in Grisez's study of 36-year old and older plantations in northwestern Pennsylvania. Board-foot yield has exceeded 200 feet per acre per year over the life of the trees in seven of the plantations. Six different species contributed substantially to the volumes in these seven plantations. One 45-year old red pine-white pine plantation that had never been thinned contained 17,700 board feet per acre of red pine--a mean annual increment of 394 board feet! Three rows of white pine alternated with one row of red pine in this plantation. The red pine outgrew the white at an early age, however, and found plenty of room to grow. Two other plantations, one where red pine was the major species and the other Japanese larch, developed much the same way.

T. A. Peterson, from the Forest Products Laboratory at Madison, Wisconsin, visited the Kane red pine seed source plantation in October. He collected large-core wood samples and data from trees representing 10 seed sources for his study of Variation of Growth and Anatomical Characteristics of Red Pine Seed Sources at Kane, Pennsylvania. The 10 seed sources used included the five sources with the highest mean value for breast-height core specific gravity and the five lowest, as determined by an earlier study.

Publications

Hough, Ashbel F.
1964. 20-year vegetation changes on the Tionesta area. Pa. Forests 54: 81, 87.

Huntzinger, Harold J.
1964. Germination, survival, and first-year growth of black cherry under various seedbed and supplemental treatments. U. S. Forest Serv. Res. Note NE-26, 6 pp.

WILDLIFE HABITAT RESEARCH

Deer Browse Production and Timber Stand Improvement in Northern Hardwoods

We have been filling in a few gaps in our knowledge of the potential benefits of coordinating timber and habitat management. A modification in non-commercial timber stand improvement in 40-60 year-old northern hardwoods [illegible] shown to yield more than a tenfold increase in deer browse production. Felling all stems except 80 square feet of residual basal area in future crop trees yielded 141,000 twigs of browse per acre in the first year after cutting. It included twigs in tops laid down the first winter, in stump sprouts that developed later and in new growth in tops in which the stems were left hinged to the stump.

The 5-year study to determine total browse production and utilization was started last year as a cooperative study between the ANF (Don Hagar), Region 7, (Bill Stiteler), and the Station (Jim Jordan). The cutting was done in 10-acre blocks near winter concentrations of deer to obtain good use of the browse.

The cutting should be equally useful in 20-40 year-old hardwood stands. It can be especially effective where the market for hardwood pulpwood is slow and where large areas of poletimber offer little relief from browse scarcity.

Response to Simulated Deer Browsing in Selected Allegheny Hardwoods

Annual removal for 3 years of the current growth of black cherry, white ash, sugar maple, and red maple seedlings has resulted in negligible mortality. Now entering their fifth growing season, many of these wild seedlings which were about 12" - 18" when transplanted, will this year begin to attain heights of over 5 feet. Seven different clipping treatments have so far kept them within the height to which deer can browse. Black cherry and white ash sprout readily in response to clipping; sugar maple and red maple do not. The latter seems almost totally resistant to sprouting, regardless of the level of simulated browsing. We learned with mixed feelings that meadow mice have a special taste (in winter) for black cherry and white ash and that partial girdling is similar to clipping in that sprouting at the root crown is the rule.

Short lengths of field tile baited with "Warfarin" pellets in the late fall, plus a stem spray of a rodent repellent saved seedlings. We've not been in a mood to test the comparative effectiveness of the preparations.

Small Rototilled Food Plots for Ruffed Grouse Production

Tests of the effectiveness of small rototilled food plots in increasing grouse populations have so far shown negative results. Grouse broods will be censused this spring as part of the cooperative study with the Fish and Wildlife Service. Ward Sharp is leading the work in this study.

Publications

1. Jordan, J. S., Donald Hagar, and William Stiteler. Deer Browse Production and Timber Stand Improvement in Northern Hardwoods. North American Wildlife Conf. Trans. 1965.

2. Shafer, Elwood L., Jr. Deer Browsing of Hardwoods in the Northeast. U. S. Forest Service Research Paper NE-33. 1965. 37 pp.

GENERAL

We moved into our offices in the new Laboratory in October. The transition was both rapid and welcome. The finishing touches, some small and some large, are currently being made to the building site to bring it into character with the research installation.

The new conference room, one of many outstanding features of the Laboratory, has already filled a special need by our own staff and that of the Allegheny National Forest for special meetings. We anticipate that it will also be used by local groups for resource-oriented meetings.

Some personnel changes have been made since our move. Larry Willett was transferred with a promotion to Administrative Assistant to the Marketing Laboratory at Princeton. We are currently awaiting the selection of his replacement. Virgil Flick, who worked with us for nearly 3 years under temporary appointments, is now a welcome addition to our permanent staff as a Forestry Aid

An important addition was made to our plant collection. The herbarium of the ANF, containing over 300 specimens, was transferred to the Laboratory. The specimens, collected in 1936, are still in excellent condition. These, when combined with our own, nearly doubled the size of the collection.

KINGSTON UNIT

Semi-Annual Report, October 1964-March 1965

MINE SPOIL RESEARCH

Passage of the Appalachia Bill has focused attention on mine spoil research in Pennsylvania. The fact that the Station had the foresight to initiate a program of research in this field has enabled Pennsylvania to take full advantage of the mine area restoration provisions of the bill. As far back as October 1964, Grant Davis appeared before the Coal Area Task Force to explain the status of research and the necessity of revegetating coal mine spoils in Pennsylvania. This Task Force is composed of members of several Departments of the Commonwealth of Pennsylvania and was set up by Governor Scranton to coordinate state and federal programs to improve the economy of the coal areas.

Both Czapowskyj and Davis, have worked closely with various county planning commissions to acquaint them with the Station's research programs, offer technical assistance, and advise them of information on reclamation presently available.

Bituminous Region

The Guide for Revegetating Bituminous Strip-Mine Spoils in Pennsylvania has been completed. It should be available to give technical information on reclamation for this spring planting season. This publication was edited by Grant Davis with the assistance of several members of the Research Committee on Coal Mine Spoil Revegetation in Pennsylvania.

During April and May 1964, 36 plots were established on extremely acid soils to find which, if any, species of birches, alders, locusts, and various shrubs are suitable to such adverse sites. First-year survival was generally disappointing, and some plots failed completely. The unfavorable spring weather probably contributed to the unsatisfactory results. Plots with average pH of 2.9 and below supported only scattered individual seedlings. Some plots in the range of pH 3.1-3.3 had over 80 percent survival of some species. Gray birch and European white birch (Betula pendula) were the most successful species. Of the alders, (Alnus glutinosa) survived the best, but there was considerable variation of performance of the several seed sources from plot to plot.

First-year survival counts of trees and shrubs planted on the El Camton mine area restoration plots were tallied in the Fall of 1964. Three demonstration areas had been treated with various combinations of lime and fertilizer before planting in the spring of 1964. On the two areas where the controls were planted in spoils averaging about pH 4.5, lime and fertilizer treatments did not account for any significant increase in survival. On the more acid spoils averaging around pH 3.0, treatments increased survival, but the results were generally poor and inconsistent. The poor growing season in 1964 probably had some detrimental effects on overall survival. It is interesting to note that average pH dropped almost 0.5 from March to October on all three sites.

Anthracite Region

The major portion of the winter months was spent on (a) preparation of manuscripts, (b) analysis of data, and (c) writing of working plans for new studies.

The manuscript "Survival and early growth of planted forest trees on strip-mine spoils in the Anthracite Region" has been completed and submitted for editing. It will be published as a Station Research Paper sometime during 1965.

Second-year survival of forest tree species planted on anthracite mine spoils in Pennsylvania has been completed and the manuscript is in the process of preparation.

First-year survival and height growth data on 28 clones of hybrid poplar planted on anthracite deep- and strip-mine spoils were tabulated.

Two working plans for studies to be established this spring are in the final stage of preparation. They are: (a) Performance of crown-vetch (Coronilla varia L.) planted and seeded on anthracite deep-mine spoils, (b) The response of red pine and Japanese larch planted on anthracite deep-mine spoils under various lime, fertilizer, and mulch treatments.

Our principal cooperator, Pennsylvania Power and Light Company, has produced a 12-minute colored film--"Operation Trees"--which is used in their program to promote the revegetation of the Anthracite Region. A portion of the film includes scenes from the Kingston Unit's laboratory showing Ed Sowa analyzing spoil material.

We were pleased to learn that PP&L wishes to cooperate further with the Station.

During this period M. Czapowskyj held several conferences with PP&L officials concerning their program to plant 300,000 seedlings to screen coal mine banks this spring.

Miscellaneous

Miro Czapowskyj acted as an advisor on a high school science fair for Miss Mary Gildea from Coaldale, Pa. Miss Gildea's project was titled "Can culm banks be reclaimed". Her project was successful and she won third prize at Marion High School in Tamaqua. Her project was also exhibited at the regional science fair at Muhlenberg College in Allentown.

LACONIA UNIT

Semi-Annual Report, October 1964-March 1965

TIMBER MANAGEMENT RESEARCH

General

The last formal show-me trip for the season at Bartlett was on October 8 for the County Foresters of New Hampshire. The group was primarily interested in birch regeneration, weeding, thinning, pruning, and decays caused by branch stubs.

Ted Grisez and Harold Huntzinger paid us a visit at Bartlett on October 14.

Doolittle and Filip participated in a recent G.F.I. on the White Mountain National Forest made by Mason Bruce of the Washington Office. Visits were made to timber sale areas in the Evans Notch District.

Filip presented a paper on "Cost of chemical frill girdling under an intensive management program in northern hardwoods" at the Northeast Weed Control Conference in New York and participated in a panel discussion on "The heartrot problem as seen by the silviculturist" at the winter meeting of the Northeastern Forest Pest Council at Boston.

Jensen, Filip, Solomon, and Hoyle attended the New England Section S.A.F. meeting in Boston on March 11 and 12.

Filip attended the October joint meeting of the Society for Protection of N. H. Forests and the Granite State Chapter S.A.F. at Concord.

Hoyle presented a paper at the annual meeting of the Soil Science Society of America, Kansas City, Missouri, November 15-19. He also attended the Shade Tree Conference on March 9; and gave a talk, illustrated with slides, at the Northeast Forest Pest Council, March 10, in Boston.

Victor S. Jensen

After a week at Estes Park, attending the S.A.F. meeting in Denver, and a couple of weeks in Idaho, returned home by way of Michigan, southern Ontario and Quebec. After a couple of worthwhile days at Marquette with Arbogast and company proceeded to

Sault Ste. Marie, Ontario. With Harry Graham had a chance to see a large yellow birch regeneration program where conifers were planted on the scarified strips to supplement natural yellow birch. In Algonquin Park controlled burning to obtain a yellow birch reproduction is being attempted as an alternative to mechanical scarification. In some sections of the Park deer exclosures mean the difference between good and practically no yellow birch regeneration. Only the visitor appreciates the scope and variety of work at the Petawawa Experimental Forest and Laboratory. Andre Linteau is initiating a very comprehensive yellow birch regeneration study at Windsor, Quebec that will bear watching.

Jury duty was the most important project for a two-month period. Several land taking cases were professionally very informative. In order to succeed in forest management without trying, be sure trees are growing over a deep gravel deposit or on a potential residential building development.

Stanley M. Filip

Compartment Management. A progress report has been practically completed on logging costs and returns covering the first 10-year period of this study--1950 to 1959. One of the most important factors revealed in the report is the percentage of products removed by method-of-cutting in old-growth northern hardwood stands.

Cutting Method	Area Cut (acres)	Logs and P. B. Millwood (Percent)	Pulpwood (Percent)
Selection system	508	39	61
Diameter-limit (14")	80	62	38
Patches	24	29	71
Liquidation	41	49	51

Except for the diameter-limit cutting, from one-half to two-thirds of the harvested material was pulpwood. In the diameter-limit cutting, where only sawtimber size trees (plus paper birch poletimber) were harvested, the proportion was practically reversed.

With today's poor market for hardwood pulpwood in New Hampshire, a difficult situation exists to get contract cutting done in this study. Our principal product will continue to be pulpwood for many more years. However, good markets are available for high-quality hardwood logs and birch millwood.

David A. Marquis

The birch shading study has been completed and the data is now being prepared for publication. Very narrow east-west or north-south strips proved best for germination and survival. The orientation was less important than the width in these narrow strips, the important point being that they provide the maximum amount of shade. Growth in the shaded strips was less than that in full sunlight, but differences in growth between the various strips were not significant. Paper birch root-shoot ratio was drastically reduced by shade; yellow birch was not so affected, suggesting one possible reason for the ecological differences in the two species.

A working plan is being prepared for a cooperative study of strip cutting on the White Mountain National Forest. An area of about 100 acres has been selected in Evans Notch; it will be clearcut in 50-foot wide east-west strips. Every third strip will be cut in 1965 and this process will be repeated in 1967 and 1969 so that the entire area will be cut over a 5-year period. Additional treatments in the study will include soil scarification, direct seeding, and removal of unmerchantable material. Although set up as a study, the timber will be advertised and sold as a normal timber sale.

Data from the thinning study in 25-year-old northern hardwoods has been punched onto cards for EDP. Statistical analyses will be run on various segments of the data to determine the effect of thinning on growth (diameter, basal area, volume, and height) and quality (as evidenced by bole class, presence of epicormics, rate of natural pruning, taper, presence of forks, presence of bole defects, etc.). Various interrelationships will also be examined such as the effects of various crown dimensions on growth, differences in response by crown class and species, etc. The Biometrics Unit at New Haven has been especially helpful in preparing the way for computer processing.

Dale S. Solomon

The initial measurements were taken and each tree marked on the study of the effects of stand density and size distribution on the growth of uneven-aged, second-growth northern hardwoods. The study is established and does not require any more work until remeasurement 5 years hence.

Field work has been completed for the comparison of prism cruising with 1/4-acre plots on different stand conditions. The data is presently being compiled.

Field work has also been completed and the data analyzed for a study of stump sprouts of northern hardwoods under partial cuttings. The results show definitely that red maple sprouts most prolifically, sugar maple and paper birch less, and yellow birch can be considered as a non-sprouter.

Merrill C. Hoyle

This past winter was primarily devoted to writing manuscripts and working plans. Several meetings were attended. Working plans to evaluate the effects of phosphorus fertilization on yellow birch under field and laboratory conditions are in preparation. Work is in progress to determine adequate methods for determination of six microelements in plant tissue.

WATERSHED MANAGEMENT RESEARCH

Automatic Date Processing

Streamflow records from seven watersheds are now being processed by computer. This is made possible through our cooperative agreement with Dartmouth College. A G.E. 325 computer is available to us. Time and head values are transcribed manually from the charts to forms and then are punched onto cards. Computer outputs include flow between time intervals and daily and monthly totals. A subroutine for flow frequency classification will soon be included. We anticipate the ADP system will allow us to keep streamflow records current to within one month following chart removal.

Winterized Stream-gaging Stations

For three years we have used bottled-gas heaters to reduce freezing in gage-house wells. This winter, mouse-chewed plastic tubing and unexplainably extinguished pilot lights have caused several explosions of accumulated gas when the re-lighted burner was returned to the well. We have replaced the plastic tubing with copper, increased ventilation, and purchased devices which automatically shut off the gas flow when the burner is extinguished.

Snowmelt Runoff

Initial attempts at predicting snowmelt runoff have led to the equation

$$Y = 0.149 + 0.009\ (T - 32)^2$$

in which T is the maximum daily temperature in ^{o}F and Y is daily snowmelt in area inches. The exponential decay equation has been used to distribute the daily contribution from melt (Y) and from rain into a recession over several successive days. Decay constants of 0.03"/hr. for snowmelt and 0.05"/hr. for rain gave the best fit to observed hydrographs. The different values required indicate that rain water reaches the stream faster than snowmelt.

Wind Profiles

Measurements of wind profiles over forest stands suitable for determining the surface roughness and zero-plane displacement are practically non-existent. We are beginning a study to measure profiles over pine plantations and northern hardwood forest. We would appreciate hearing of any prior measurements of this type that have been made.

Water Budget Computer Program

A study is planned to write a computer program to predict daily streamflow and soil moisture from known daily precipitation and from both Thornthwaite and solar radiation estimates of potential evapotranspiration. A number of different techniques will be tried to see which agree best with observed streamflow.

Winter streamflow

Sustained winter flows of 0.007 to 0.020 area inches per day throughout the winter can be explained by conduction of heat from within the soil to the bottom of the snowpack causing snowmelt. Measured soil temperature profiles and estimated soil thermal conductivities lead to estimates of this groundmelt which agree with the measured streamflow.

Open House

The tenth anniversary of the Hubbard Brook Experimental Forest was celebrated last October with an Open House. Director Ralph Marquis led the ceremonies with talks from station personnel and Clark Holscher from the Washington Office who explained the purpose of the Hubbard Brook program and discussed the past, present, and anticipated future research in Watershed Management. The Honorable Thomas J. McIntyre, United States Senator from New Hampshire, gave the address to: Officials from the Forest Service, Soil Conservation Service, State, County, and nearby towns; representatives from Dartmouth College and the University of New Hampshire; and the general public. Exhibits of research work underway and guided tours of the new headquarters buildings and the Experimental Forest complemented the festivities.

Meetings and Travel

Hubbard Brook was the site of the biennial Northeastern Station-Region 7 Watershed Management Seminar on October 20-22, 1964.

Pierce and Federer toured Forest Service and Agricultural Research Service research installations at New Philadelphia and

Coshocton, Ohio; Parsons and Princeton, W. Va.; Franklin (Coweeta) and Research Triangle Park, N. C.; and Upper Darby, Pa. as well as the Forestry Schools at Duke University and North Carolina State on a two-week trip in December.

Pierce, Federer, and Hart attended the Eastern Snow Conference at Hanover, N. H., February 4 and 5, 1965. The Cold Regions Research and Engineering Laboratory (CRREL) was the host agency.

Federer attended the New England Section meeting of the Society of American Foresters in Boston, March 11 and 12, 1965.

Pierce attended a Station-Region meeting in January at Upper Darby on Watershed Management.

Visitors

Visitors to the Laconia project included Dr. Donald P. Mader of the University of Massachusetts and Dr. Richard Lee of the University of Connecticut (formerly with the Rocky Mt. Forest and Range Expt. Sta.). Clark Holscher from the Washington office spent several days with us on a Washington office inspection and participated in the Hubbard Brook Open House.

Publications

Hubbard Brook Experimental Forest. Northeastern Forest Experiment Station. Misc. Publication. 1964. 13 pp., illus.

Manuscripts submitted:

The spectral distribution of light in the forest. C. A. Federer and C. B. Tanner.

Sensors for measuring light available for photosynthesis. C. A. Federer and C. B. Tanner.

Artificial light for plant growth. C. A. Federer and C. B. Tanner.

A simple integrating pyranometer for measuring daily solar radiation. C. A. Federer and C. B. Tanner.

Watershed Management Research in the Northeast. R. S. Pierce.

NEW LISBON PROJECTS

Semi-Annual Report, October 1964-March 1965

TIMBER-MANAGEMENT RESEARCH

Because of family problems, John Phillips, our soil scientist, resigned in early December to return to his family home in Wisconsin. On December 31 Little was notified that the New Lisbon timber management project would be closed as of June 30. Present plans for the remaining personnel are as follows: In June Dick Fenton will transfer to Princeton, W. Va., and George Keiser to Burlington, Vermont. Horace Somes and Si Little and Dot Somes will be transferred to Upper Darby. However, Horace Somes would continue to work at or out of New Lisbon on existing studies, and presumably most, if not all, of Little's time would be on these.

As usual, an appreciable amount of time was spent on manuscripts, and some on meetings and visitors. Several papers were revised, some galley and page proofs checked, and the early drafts of some manuscripts written. The fire plan was also revised. Little attended the Allegheny Section meeting in Pittsburgh in February. On February 19 three men from Manitoba or Ontario offices of the Canada Department of Forestry visited our office to discuss fire ecology, silvicultural role, and application techniques with project and State personnel. They also saw a small demonstration of prescribed burning. On March 18 and 19 Little met with Assistant State Forester A. R. Bond and State Soil Scientist Merl Hershberger and his assistant, Earle Matthews, of the SCS to discuss and revise woodland sections of two county soil survey reports--dealing with Coastal Plain soils in southern Maryland and Piedmont soils in central Maryland.

Field Work

Much work was done on establishing a breeding orchard of grafted loblolly and pitch pine seedlings. In early October 433 loblolly seedlings and 220 pitch pine seedlings were planted, representing 29 loblolly clones and 26 pitch pine clones. Subsequently seedlings were mulched with wood chips and periodically watered, and later pruned. A deer fence was erected around the orchard, and later a firebreak burned around it.

For the most part, we have had fairly good success in obtaining the desired number of grafted seedlings per clone--largely because of Westvaco's excellent work in grafting, tending the seedlings, and preparing them for shipment. The working plan had called for establishing 5 trees of each pitch pine clone and 10 trees of each loblolly clone, so to allow for some mortality we wanted to plant 8 pitch pines or 15 loblolly pines of a clone. Seedlings planted last fall included 13 to 20 loblolly pines per clone for all except three clones: for one of these 10 seedlings were planted, for another 6, and for the third none. Grafts of the last were almost a complete failure, as they were for one pitch pine ortet (source tree). In addition, no scions had been collected from a fourth pitch pine in West Virginia. For the other 26 pitch pine ortets, grafts were sufficiently successful so that 8 to 10 seedlings of each were planted at New Lisbon.

This spring an effort is being made to fill blanks in the desired number of scion sources and grafted seedlings. Already we have collected scions from one loblolly replacement and from the tree which had given us only six grafted seedlings for the New Lisbon orchard. Dave Sowers will collect, or has arranged for collection of scions, to fill the two pitch pine gaps, and in early April Little will go to Maine to obtain scions from another pitch pine there. Grafts of scions collected from one Maine tree last year may yet fail: at least many needles have fallen from the scions of the seedlings moved to New Lisbon. For the most part, survival in all other clones of the New Lisbon orchard gives promise of being high, even though the loblolly ones suffered some winter injury.

Fenton and Keiser completed most of the scheduled establishment and treatment of plots in the yellow-poplar regeneration study, receiving in this work appreciable help from Maryland and New Jersey foresters. With the help of Jack Denniston of the Pennsylvania Department of Forests and Waters, Reigner and Little made a vegetation survey of the Dilldown Watershed and revised the estimates on conversion work desirable there to provide high forests. In South Jersey, some prescribed burns were made: plots were treated in one study near Buckingham; the headquarters area and some nearby tracts or firebreaks were also burned.

Results

The Dilldown survey showed a surprisingly small amount of conversion work that was considered desirable and feasible, in part because 530 acres in a 1955 wildfire burn are now well to densely stocked with aspen. Presumably this species will reach a "high-forest" category on these sites. A total area of only 130 acres was recommended for conversion: 15 acres that should be interplanted, 2 acres of root-raked areas that should be replanted, 15 acres that could be root-raked and planted, and 98 acres that should be seeded, mostly on humus. The amount of conversion work is greatly reduced from earlier estimates that indicated the need for seeding on possibly 700 acres.

Ten-year results from thinning 7- and 17-year-old Virginia pine stands in Maryland's Cedarville State Forest indicate that noncommercial thinnings of similar stands cannot be recommended. The thinning left 900 codominant or dominant stems per acre, and removed about 8,600 and 2,000 trees per acre, respectively. In the following 10 years crop-tree losses were high in the unthinned stands and in the one thinned at 17 years: in the last, 31 percent compared to only 4 percent in the stand thinned at 7 years. Weather factors were responsible for most of the mortality in the thinned 17-year-old stand. Surviving trees gained 50 percent more in diameter in 10 years in the 17-year-old thinned stand, but no more in the thinned 7-year-old stand than crop trees in the unthinned areas. Of course, high mortality and changes in crown class caused changes in stems selected as crop trees in the 7-year-old unthinned stand. In both stands basal-area growth of 900 stems per acre was not increased by thinning, although diameter and basal-area growth per acre of the 200 largest trees were increased. Even so, similar noncommercial thinning seem undesirable because (1) this is primarily a pulpwood species and one very subject to losses from wind, snow, or ice in partially cut stands and (2) increased growth of surviving released trees will apparently not offset such losses nor provide the volumes of unthinned stands in a pulpwood rotation.

WATERSHED MANAGEMENT RESEARCH

This, I fear, is the swan song for the New Lisbon project on Municipal Watershed-Management Research. The New Lisbon station is being closed after an uninterrupted period of 31 years of productive research in silviculture and timber management nearly all of which has been under the leadership of Si Little. The watershed project at New Lisbon is an upstart, having been here only 6 years.

Irv Reigner and Karl Nicholas are being transferred to Parsons, W. Va., where they will attempt to carry on the municipal work as usual.

Before leaving, however, we are pleased to report the results of preliminary analyses on the calibration of the cooperative watersheds at Baltimore and at Newark. Both of these calibration analyses turned out very satisfactorily.

Baltimore Watersheds

Two of the three experimental subwatersheds near the Liberty Reservoir have records dating back to August 1958, but records for the third did not begin until November 1959. Thus, the data for Watershed No. 3 are rather meager for calibration. Furthermore, the yield of this watershed has been so low that a leaky aquifer was suspected, and the possibility of calibration was considered doubtful. To our surprise, the correlation of this watershed with the control watershed (No. 2) is about as good as that of Watershed No. 1 which was obviously well-correlated with the control. And the low yield could well be caused by the difference in cover. The cover on No. 3 is a mature hardwood forest, in contrast to young pine plantations covering the other two watersheds. The water-loss value (P-RO, and presumed to be evapotranspiration) is almost exactly the same as the estimated evapotranspiration on the control watershed at the Fernow Experimental Forest in West Virginia, a watershed with comparable cover.

The following tabulation presents the pertinent data and results of the analysis:

Watershed	Period	Calibration	Mean precip.	Mean runoff for calibration period	Corr. coeff. r	Std. error of est. $s_{y.x}$	Increase required to show significance at 5-percent level
			Inches	Inches		Inches	Inches
#1	Annual	Six Oct. 1 years	36.70	10.20	0.947**	1.09	2.52
#3	Annual	Four Oct. 1 years	36.07	4.16	0.985*	0.48	1.56
#1	Growing season	Six years	17.28	3.80	0.969**	0.48	1.10
#3	Growing season	Five years	16.98	1.82	0.963**	0.30	0.67
#1	Dormant season	Six years	19.28	6.30	0.950**	0.54	1.26
#3	Dormant season	Five years	20.94	2.22	0.914*	0.56	1.44

*Correlation significant at 5-percent level.
**Correlation significant at 1-percent level.

Howard Lull and Irv Reigner met with Lou Ningard and Ron Singer, respectively the Superintendent and Forester of the Baltimore watersheds, to develop plans for the future conduct of the experiment. It was decided to begin treatment on Watershed No. 1 this coming October with the removal of the riparian vegetation. Subsequent treatments on this watershed will entail the gradual thinning of the pine plantation.

Because Watershed No. 3 has recorded only four October 1 years, treatment will be held off until October 1966, at which time a partial cutting will be made, probably on a diameter-limit basis. Eventually, all the forest cover will be removed from this subwatershed, to test the extreme of watershed treatment. Logging will be done as carefully as possible, to maintain water quality and the present character of the land surface.

Newark Watersheds

The second of the two analyses was completed only a few days ago and no conference with the watershed managers has been held as yet. But this calibration has been even more successful than at the Baltimore watersheds and treatment may be initiated at any time.

The three subwatersheds on the Pequannock Watershed owned by the City of Newark, New Jersey, have been in their calibration phase since May 1959. While only slightly larger than the Baltimore watersheds, the differences in precipitation, climate, and water-holding capacity make very interesting comparisons between the two experiments.

The following table, presenting data and results of the analysis, shows that the standard errors of estimate ($s_{y.x}$) are in the same order as at Baltimore, but that the correlation coefficients are much higher. This is due to the much higher yields from the Newark watersheds with consequently greater variances in annual and seasonal yields. The higher yields are due, of course, to the heavier precipitation and cooler climate.

Watershed	Period	Calibration	Mean precip.	Mean runoff for calibration period	Corr. coeff. r	Std. error of est. $s_{y.x}$	Increase required to show significance at 5-percent level
			Inches	Inches		Inches	Inches
#1	Annual	Five May 1 years	47.06	23.05	0.993***	0.91	2.34
#3	Annual	Five May 1 years	47.15	21.64	0.996***	0.67	1.73
#1	Growing season	Six years	21.82	4.03	0.999***	0.16	0.37
#3	Growing season	Six years	21.91	4.00	0.995***	0.43	0.98
#1	Dormant	Five years	23.56	18.53	0.984**	0.79	2.03
#3	Dormant season	Five years	23.53	17.16	0.998***	0.32	0.82

**Significant at 1-percent level.
***Significant at 0.1-percent level.

Only 20 percent of the mean annual yield is delivered during the growing season, as against 40 percent at Baltimore, indicating that the steeper and rockier slopes on the Pequannock Watershed have less water-holding capacity than the rolling Piedmont lands near Baltimore.

Meetings

Irv Reigner took part in three meetings during the semi-annual period:

1. The watershed-management workshop at Hubbard Brook, New Hampshire, attended by the watershed-management researchers of the Northeastern Forest Experiment Station and the watershed management administrators in Region 7.

2. The watershed-management symposium held in Region 7 offices in Upper Darby. Recommendations emanating from the above

workshop were acted upon at this symposium.

3. The annual winter meeting of the Allegheny Section, Society of American Foresters, at Pittsburgh. Reigner moderated the morning technical session and served on the Section Executive Committee.

ORONO PROJECT

Semi-Annual Report, October 1964-March 1965

For the second winter in a row snow was conspicuous by its absence. Logging conditions were ideal, with good trafficability and a minimum of time lost due to inclement weather. As we approach spring the water table is low, and stream waters are below normal. Unless spring rains come soon the forest fire danger will be high.

Management Unit Program

The second unit of a proposed 10-unit management area is about 80 percent harvested. Like the first unit, a heavy improvement cut will remove approximately half the original stand volume. A third unit will be established this field season.

Strip Width-Slash Disposal Regeneration Study

After completion of the 100 percent inventory of the 54-acre study area, Orman Carroll and his cutters have been at work all winter making the prescribed cuttings. Given continued excellent weather conditions and no reduction in manpower we should complete all cutting and skidding by the end of April.

Seedtraps to be used in the study were manufactured and are being assembled. They will be placed in the field during May or June.

Windfirmness After Strip Clearcutting

A supplementary informal study was started to observe uprooted or broken trees which may occur in the seed-source areas of the above study. We will be particularly concerned with those fallen trees along the edges of the clearcut strips. However, we will observe and record all uprooted and broken trees in the 2-chain wide seed-source areas. Observations will be made on all areas each month.

Soil-Site-Growth Study

Dry weight Production: An attempt to relate 10-year dry weight increase of the entire stand on the cooperative growth study plots to some generalized soil types was made. All trees--sound, cull, living and dead--on each plot from 1 inch DBH upward were listed on a tally sheet. The dry weight of fiber present at the time of plot establishment and ten years later were calculated using the University of Maine 1620 IBM computer and forest inventory program with a local weight table substituted for the volume table. The local weight table was prepared from basic data of Harold Young[1] by extrapolating curves down to 1 inch DBH and up to 30 inches DBH and by combining some species.

Plots were sorted into the following generalized soil types.

1. Organic soils--more than 12 inches of organic matter (usually peat or much greater than 3 feet deep).
2. Shallow till-- glacial till soils less than 24 inches to bedrock.
3. Deep till,wet--very poorly and poorly-drained glacial till 24 inches or more to bedrock.
4. Deep till, moist--somewhat poorly and moderately well-drained glacial till 24 inches or more to bedrock.
5. Deep till, fresh--well-drained glacial till 24 inches or more to bedrock.
6. Outwash--glacio-fluvial sand and gravel deposits well to excessively drained.

Regressions of increase in weight on initial weight were run for each soil type with the intent of testing for differences among resulting equations. However, the coefficients of correlation (R) were very small in all cases, indicating almost no correlation between initial stand weight and stand weight increase.

Since initial stand volume was a highly significant variable in predicting 5-year volume growth in previous analyses, it was concluded that the weight figures obtained by extrapolating the weight curves and combining species were not sound and no further analyses using weight were attempted.

1/ Young, Harold E., L. Strand, and R. Altenberger. Preliminary fresh and dry weight tables for seven tree species. Maine Agri. Expt. Sta., Tech. Bul. 12, 79 pp., 1964.

Height Diameter Relationships. The hypothesis has been made that height over DBH curves might be used in place of height over age curves to estimate site index in uneven aged stands of tolerant species[2]. To test this hypothesis height over DBH curves were obtained using height-DBH measurements from spruce and fir sample trees on the growth plots for each of the previously described soil types.

There appear to be no strong differences among height over DBH curves for spruce and fir sample trees when plotted for a single stand type of 5 broad soil types or for a single soil (soil type 5) by stand class. There is a difference between spruce and fir curves on the deep well drained till soils, but none is apparent on the other soil types.

The growth study sample tree curves tend to diverge at the higher diameters--above 10 inches, but data in these classes are limited. Plotting McLintock's raw data, all of which comes from trees 10 inches DBH and larger, tends to pull the curves closer together.

When a composite curve of all stand types on soil type 5 is compared with McLintock's site index curves there is a good fit with site index 70 above the 14 inch DBH point. If composite curves for other soil types show similar good fit with different site index curves, the indicated site index values may be tried as quantitative expressions of soil type in future regression analyses in the soil site growth study.

Further analysis will be done as soon as the 10-year volume growth calculations are complete.

Wildlife Damage

Observations of wildlife food habits were continued, being concentrated last winter mainly on red squirrels, crossbills, and evening grosbeaks. Observations of red squirrels emphasized the necessity for continued observations of wildlife food habits: During the winter of 1963-64 the squirrels had to subsist mainly on conifer buds. Last winter squirrels in the same areas used few buds; they fed heavily on a bumper crop of hemlock cones that continued to hold some seeds nearly all winter.

2/ McLintock, T. F. and C. A. Bickford. A proposed site index for red spruce in the Northeast. Northeastern Forest Experiment Station Paper #93, 30 pp., 1957.

The large numbers of crossbills here from September to November 1963 didn't return in 1964. A few flocks of whitewing and red crossbills did provide some additional observations of their feeding habits on conifer cones. Again, hemlock seemed to be preferred by crossbills familiar with an area, from early September on, but generally after white spruce seeds had been dispersed (and where both conifers occurred). Hemlock cones were the major source of food for a family of red crossbills (the lower part of the male's bill crossed to the left) from October to at least February. Transient red crossbills, upon arrival from December to February, seemed to prefer working the red spruce cones still on the trees but nearly empty of seeds. Many seeds remained in hemlock cones. Perhaps the transients were more familiar with spruce.

A small flock of whitewinged crossbills that fed heavily on larch (*L. laricina*) cones last July provided information about the number of cones they plucked. All cones dropped by crossbills were collected under one tree between July 22 to 28 and totaled 6,416. The October 2nd collection brought the total to 10,735 cones removed from this 10" larch. The birds later switched to nearby red spruce cones, probably in early September judging from the condition of 393 cones collected under an isolated 9" spruce.

Tree specimens fed on by wildlife, and red squirrels eating maple sap were photographed in the Lab and field.

The library stacks at the University of Maine provided a pretty good refuge when the weather was rough.

Dispersal of paper birch seed into a clear-cutting

In a study to determine the pattern of paper birch seedfall into a clear-cutting, two lines of traps were located so as to bisect the sides of the clear-cutting. These lines were oriented roughly N-S and E-W. Traps were also located in the forest stand within 1 chain of the opening.

Trapping was started August 14 and traps were checked weekly up to November 27. A heavy snow after that date precluded further checking until Spring 1965. Observations of the paper birch trees surrounding the clear-cut area suggested a very light to light seed crop this year.

Preliminary results show that the maximum paper birch seedfall per acre (4 million) occurred within the forest stand and that the amount of seed dispersed fell off rapidly towards the center of the 7 chain x 7 chain clear-cut area.

Although total amount of paper birch seed trapped on the N-S line and the E-W line was almost equal, there were differences in amount by time of dispersal. These differences are:

Month	N-S line	E-W line
	Percent of total seed crop	
August (last half)	4	9
September	26	20
October	35	19
November	35	52

Management Intensity Demonstration

The scheduled 100 percent inventory of the four 10-acre plots was made in October. A comparison of this inventory with one made 5 years ago shows the following:

Mean annual growth and mortality per acre, 1959-1964, by management intensity

Treatment	1959 Stand	Gross Increment	Mortality	Net Increment
	cu.ft.	cu.ft.	cu.ft.	cu.ft.
Commercial clearcutting	1,084	44	8	36
Diameter-limit	1,813	63	8	55
Selection	1,942	64	6	58
Intensive-selection	1,807	66	5	61

Compared with 1951, 1959 net cubic foot growth was less; from 12 percent less on the commercial clearcutting to 17 percent on the selection plot. Examination of the growth components indicates that the ingrowth component is responsible for the net growth reduction. Numbers of ingrowth trees in 1964 were half or less those found in 1959.

Three of the four plots were marked for recutting. This will be the fourth cut on the intensive-selection plot, and the second for the selection and diameter-limit plots. When the demonstration was started in 1950 we thought it would be 20 to 30 years before the diameter-limit plot grew enough wood to support another cut of equal volume based on the same diameter limits. Actually, in 15 years the plot grew more than enough.

White Spruce Thinning

The 1961 individual white spruce trees 70-75 years old and 5-6 inches d.b.h. were treated to: no crown release; crown release on 1, 2, 3, and 4 sides. Response to release was measured as increase in circumference at b.h. measured with individual band type dendrometers on 5 trees in each treatment.

The growth pattern was established the first growing season. There was little difference in average annual circumference growth for trees without release, and release on 1 and on 2 sides. Trees released on 3 and 4 sides showed greater growth than the other three treatments. However, these differences were not statistically significant until the third growing season after treatment. Both the third and fourth growing seasons showed highly significant differences. There is still no difference among the first three treatments. Rate of circumference increase for trees released on 4 sides had doubled by the third growing season, and was nearly 2½ times the first season's increase the fourth season.

The results to date indicate that white spruce trees need release on 3 or 4 sides to benefit from thinning. And, although increased circumference growth at b.h. can be demonstrated to take place early in the same growing season as the treatment, this increase is not significant until the third growing season. By the fourth growing season trees released on all 4 sides are increasing in circumference at twice the rate as those released on 3 sides.

Balsam Fir Mortality

The annual examination of tagged trees was made in October. Stem attack by balsam woolly aphid for the seven study areas as a whole showed a further increase over that found in October 1963. Thirty-three percent of the trees showed an increase in BWA rating, 53 percent remained the same, and 14 percent decreased.

Of the 393 trees tagged at the beginning of this study 11 years ago, 185 or 47 percent have died. Of these, 34 percent apparently died from stem attack by the aphid; 31 percent were broken or uprooted; 18 percent apparently died from effects of "gout" caused by the aphid; and 17 percent died of other causes.

General

In October Rush spoke at the 50th Anniversary dinner of the Bangor Bird Club on crossbill feeding habits and where to find and observe these birds.

Warren Doolittle visited us a couple of days toward the end of October; mostly on the experimental forest discussing program, studies, and improvements.

Art gave an illustrated talk to the Orono Garden Club in November, discussing some of the work underway at the Project.

Early in December Art represented the Project at the annual meeting of the Maine Hardwood Association.

Professor Herschel Abbott and Ed Ladd spent a couple of days with us around Christmastime summarizing field data taken in the study on the influence of mice and birds on spruce regeneration.

In January Terry Honer and Gordon Baskerville from north of the border stopped by for a visit.

During the period John, Bob and Larry, attended meetings of their respective county Civil Defense Boards, and Art attended state TAP meetings.

Bob and Larry participated in a Civil Defense conference given at a local high school for CD board members and game wardens.

Carl Mayer, and Andy Gilbert described current Forest Survey methods and plans at a meeting of state officials and forest land owners held in Augusta early in March to formulate plans for the re-survey of Maine.

John, Larry, Bob, and Art attended the annual winter meeting of the New England Section S.A.F. in Boston.

Bob attended the annual Keep Maine Green meeting in Augusta.

Orman participated in a meeting on woods safety and chain saw maintenance organized by the Extension Service for woodlot owners and independent loggers at Eastbrook.

Larry participated in, and Art attended, a similar meeting held in Thorndike. Both of these meetings were well attended, averaging about 150.

A meeting of the cooperators in the wood density study was held toward the end of March. Warren Doolittle, Bill Leak, and Dick Jorgensen attended from Upper Darby; Gus Wahlgren and Frank Freese for Forest Products Laboratory; Greg Baker and Jim Shotaffer for University of Maine; Ed Giddings and George Winter representing timberland owners; Bob, Larry and Art for the Project. Purpose of the meeting was to review progress, discuss presentation of results, and assign responsibilities for completion.

SYRACUSE UNIT

Semi-Annual Report, October 1964-March 1965

Shift in cooperator personnel

Roger Thompson of the College of Forestry, who worked closely with this unit in planning cooperative research studies, took a two-year's leave of absence in September to become Executive Secretary of the New York State Recreation Council in Albany. Despite the distance factor, our work will be strengthened because of a close association with the ideas and plans of this new recreation organization in the State.

Thompson's position at the College was filled by Wiley Wenger, former recreation research project leader for the Forest Service at Portland, Oregon. Wiley's intense interest in the social and psychological aspects of outdoor recreation have resulted in shifting part of our cooperative research work from "demand" models to investigation of the individual and societal non-material benefits of outdoor recreation. As a result we have submitted a research proposal to the State, including a request for financial assistance, to explore this phase of the outdoor recreation phenomena.

Preliminary results of present studies

Results of a research study involving different sampling methods, periods, and areas indicate that recreationists who use car-access camping areas in the Adirondacks are an extremely heterogeneous population with respect to expenditure patterns, motivations, sociological characteristics, resident zone distributions, and preferences and opinions about facility designs and management procedures. For any of these variables statistical interaction is commonplace rather than the exception when they are investigated across 3 summer months x 2 parks; and 5 different parks often differed significantly during one month (July). This means that recreation research studies which rely on respondent information will need to employ much more sophisticated experimental designs and sampling procedures than those which have been used previously. Statistical transformations of data and the problems and limitations of analyzing data with unequal sample sizes, (which is inherent in unbiased, random sampling of recreationists) are a few of the additional facets being investigated.

Present results of this study emphasize the need for additional "basic" recreation-mensuration research studies before large-scale national, regional, or statewide recreation-user surveys are undertaken. At the present time, estimates of population parameters and other planning factors needed in the design phase of such studies are lacking. Proceeding without them will only prove meaningless, unscientific, and wasteful.

Recreation research in general

With the above few points in mind and before recreation research proceeds too much further down its kaleidoscopic path of enquiry, it seems noteworthy here to reemphasize a point which has already been made periodically by others in the field. Namely, there has been an urge, ever since forest-recreation research has assumed importance in the forestry spectrum, to reach out into the vast, unknown abyss and snatch familiar fragments for investigation. Sometimes, this procedure has added to, rather than brought into orderly perspective, the managerial complexity of the problem. Nonetheless, this is characteristic of a new area of science in its infancy. But now it's time to stand up and try to walk. Furthermore, as Walt Hopkins has proposed, "It is time--in certain instances--to stop researching the obvious." (This unit does not plead innocent to that remark.) If researchers anticipate making rapid and substantial contributions to both the managerial and scientific areas of outdoor recreation then as John Platt 1/ suggests, let's begin to ask ourselves, "What hypothesis are you testing, sir?" lest we become nothing more than subjective journalists in an area of infinite scientific challenge.

Other cooperation.

A three hour lecture, conducted for a silvicultural graduate course at the College of Forestry, included problems and research needs in the soil, water, and vegetative aspects of outdoor recreation.

This unit collaborated with and summarized information in our files for Leonard Abrams of Vollmer Associates, a private research organization which is conducting an analysis of the outdoor recreation problems in New York State.

As a representative of the College of Forestry, Shafer attended a 1-day meeting in Hartford, Conn., of the Northeastern Agricultural Experiment Stations to assist in formulating research plans for a consumer analysis of specific forest-oriented recreational activities in the Northeast.

1/ Platt, John R. 1964. Strong inference, Science, Vol. 146, number 3642, pp. 347-352.

WATERSHED MANAGEMENT RESEARCH

Adirondack Study

Copies of Art Eschner's Ph.D. dissertation, Forest protection and streamflow from an Adirondack watershed (State University College of Forestry at Syracuse University, 209 pp., 1965) have been sent to all Stations.

Surface Geometry

This paper on disposition of intercepted snow completed by Satterlund and Eschner will soon be available as a Station Paper. On the basis of equations for turbulent heat and vapor transfer, and reasoned application of knowledge about intercepted snow, a great difference in the energy and vapor balance between an intercepted "snowfield" and one on level ground is predicted. The differences, resulting from the complex surface geometry of a closed conifer forest, are sufficient to account for considerably greater losses from intercepted snow.

Streamflow Analysis

The flow-interval technique of Satterlund and Eschner is being applied to streamflow data from five of the watersheds on the Fernow Experimental Forest by graduate student Charles Troendle.

Based on the work completed, it appears that most intervals will prove to have changed significantly since treatment. The longest one percent and five percent intervals in summer seem to have been affected the most (shortened), while some changes may be present in the shortest one-quarter and one-half flow intervals (lengthened). From the results of the analysis, it may also be inferred that following treatment, the longest one percent and five percent intervals started later in the year, as well as being shortened.

Reflectivity Investigation

The major portion of the equipment for the reflectivity investigation of a red pine plantation has arrived. Two Moll-Gorzinski solarimeters are to be passed along a tramway above the plantation. Towers supporting the tramway are of the R.C.A. 12-inch triangular type. Each 10 foot section weighs around 35 pounds, three men can erect a 70-foot tower in about four hours.

TIMBER AND WATERSHED LABORATORY

Parsons, West Virginia

Semi-Annual Report, October 1964-March 1965

TIMBER MANAGEMENT RESEARCH

Our big undertaking during the past 6 months has been the preparation for and the initiation of a large scale study of forest openings. This study is designed to produce information about reproduction in openings of different sizes and log quality changes on the exposed trees bordering them.

A total of seventy-seven openings are now being cut in undisturbed sawtimber stands on the Fernow Experimental Forest. Replicated circular plots of the following diameters are being cut: 50 feet; 100 feet; 150 feet; 200 feet and 250 feet. Excellent and fair sites are included in the study.

Three types of treatment are being carried out on these plots: (1) On one set of replicated plots all trees are logged down to 5.0 inches d.b.h.; (2) on another set of plots all trees are cut and logged down to 5.0 inches and then the stems between one and five inches are cut; (3) on the third set of plots all of the cutting as indicated in "(2)" is carried out, and in addition all stumps of trees over 5.0 inches d.b.h. are treated with a herbicide.

Briefly, for the reproduction phase of the study, the primary objective is to define the natural relationship between the size of harvest-cut openings and: (1) the species composition of reproduction, (2) the number of reproduction stems per acre, and (3) the growth of reproduction. The secondary objective is to determine if these three dependent variables are affected by the three different types of treatments on the plots.

For the log quality phase of the study, the primary objective is to determine the effect of size of opening on the occurrence of epicormic branching by: (1) species, (2) tree dominance class, (3) position on bole, (4) aspect of bole surface facing opening, (5) tree d.b.h., and (6) face of the bole; i.e. whether it faces toward or away from the opening.

In addition to this study, other research is being carried out in an attempt to rate a number of species in their relative proneness to epicormic branching. In still another study, we are trying to relate the number of visible dormant buds to tree d.b.h.

WATERSHED MANAGEMENT RESEARCH

The second cut on one of the original Fernow Five watersheds was made in 1963-64. This was on the Intensive Selection Watershed, No. 3, which has a 5-year cutting cycle. The cut was light, only 1200 bd. ft. or 9.2 sq. ft. of basal area per acre; as after the first cut, changes in discharges were generally not significant. A small but significant increase of 1,100 gallons per acre occurred in October 1964; it is of interest to note that significant increases also occurred in October 1959 and October 1960, after the first cut.

Significant increases in growing-season discharge occurred on the Commercial Clearcut Watershed (No. 1) in 1957, 1958, 1959, 1960, and 1962; the increase in 1961 was not significant. Study of precipitation data sheds some light on the 1961 situation; variation in precipitation was not considered in the original analyses. During the 12-year period of record, growing-season precipitation of No. 1 averaged 102 percent of the Control. In 1961, it was only 97 percent of the Control; this was the only post-treatment year when it was less than the Control. This apparently explains why the 1961 increase was not significant and the 1962 increase was. Nineteen-sixty-two, the fifth season after completion of treatment, was probably the last year for significant increases. In the 1963 and 1964 growing seasons, computations indicated very little difference from the pretreatment relationships; slight negative changes were indicated.

We finally completed the first-round treatment of watershed Upper 7 where we are aiming at complete removal of vegetation. Treatment consisted of a pre-logging basal spray, logging and small products operation with silvicide treatment of sapwood, a felling of residuals, a mistblowing application early in the growing season and a second spot-application with mistblower in August; all herbicide used was the octyl-ester of 2,4,5-T. We estimate that this treatment (not including sawlog and small products operations, which paid for themselves) cost us just over $50 per acre. The results were good, though not perfect.

Watershed Lower 6 has received the same treatment except for mistblowing; this will be undertaken in the coming growing season (along with repeat application on Upper 7). In future treatments, the presence of grass, which is not susceptible to 2,4,5-T, will have to be dealt with.

Preliminary analyses indicates that on Watershed 7, in the 1964 growing season, the increase was slightly over 7 area-inches (or almost 200,000 gallons per acre) on the treated area. During the season, cutting on No. 6 was not complete and the increase in flow was much less.

We were pleased to be able to supply Fernow records to one of Art Eschner's students (Charles Troendle) at Syracuse. He is analyzing to see the effect of watershed treatment on the minimum 1/4 and 1/2 flow intervals and the maximum 1 and 5 percent flow intervals. We will be interested to see the results of this study.

Our Commercial Clearcut Watershed was cutover in 1957-58. In 1957 (before cutting) and in 1961 and 1964, we took measurements of the depth of the H + A_0 layers. The mean values for the clearcutting look interesting: 2.39, 2.04, and 1.65 inches in 1957, 1961 and 1964, respectively. It appears that treatment had a real effect. But the Control showed 2.40, 2.02 and 1.33 inches in the same years. Our simple method of cutting a hole and optically determining the proper depth is apparently not working. We tried hard to avoid personal bias; in 1964 we got back on detail the man who did the job in 1961. Suggestions will be welcomed on a better approach to determining changes in humus as a result of clearcutting.

We now have the opportunity to purchase solar radiation, soil-moisture, and some other equipment that we have been wanting for many moons. The necessity of making decisions that we will have to live with a long time means that we approach this task with mixed emotions.

A start has been made on assembling background material for the new problem analyses. We expect to prepare two of these:

(1) Flood flows from rainfall and from combined rainfall and snowmelt.

(2) Low streamflow during summer and fall months.

GENERAL

Bill Wendel, Clay Smith and Dick Trimble visited Timber Management research installations of the Central States Forest Experiment Station near Athens, Ohio in late February.

Mrs. Sandra Barr has been appointed to a permanent position as Clerk-Typist to do record keeping on the Watershed Management Research Project at Parsons.

John Campbell, the newest member of our logging crew, is a first-time proud Poppa of a baby girl. The Jim Hornbecks announced the arrival of Russel James on March 9.

Visitors

We have had 58 visitors in 11 trips during the past six months. In addition, 11 foreign foresters from three countries have received training with our unit.

Meetings

Dick Trimble attended the Allegheny Section, SAF, meeting in Pittsburgh on February 11 and 12.

Ken Reinhart attended the annual meeting of the Northeastern Weed Control Conference on January 6-8, where he presented a paper on "Herbicidal Treatment of Watersheds to Increase Water Yields". He also attended the annual meeting of the Forestry Association in Virginia, January 20 and 21, where he presented a paper "Thirteen Million Pounds".

Paul Smithson attended the annual meeting of the West Virginia Sawmill Operators Association October 30 and 31.

The annual meeting of the Advisory Committee to the Timber and Watershed Laboratory was held October 19, 1964. The main part of the program was devoted to discussion of some of the timber management research results to date and their implication in practical forest management. The meeting was attended by 25 members and guests.

Reinhart and Hornbeck attended the Second Symposium on Water Research, March 25-26, sponsored by West Virginia University, W. Va. Chamber of Commerce, W. Va. Dept. of Natural Resources, and the W. Va. Geological and Economic Survey.

Reinhart and Hornbeck participated in the Region-Station workshop at Hubbard Brook, Oct. 20-22, 1964. This was a forerunner to the biennial Region-Station seminar at Upper Darby on January 14 and 15; Reinhart attended the seminar.

MANUSCRIPTS PUBLISHED

	Title	Author	How Published
1.	Frequency of Streamflow Measurements Required to Determine Forest Treatment Effects	Reinhart	Research Note NE-23
2.	The Importance of Dew in Watershed Management Research	Hornbeck	Research Note NE-24

3.	Frequency of Streamflow Measurements Required to Determine Forest Treatment Effects	Reinhart	Proc. of Conf. on Streamflow Records, Fort Collins, Colo.
4.	Streamflow Records on Experimental Watersheds of the Northeastern Forest Experiment Station	Reinhart	"
5.	Herbicidal Treatment of Watersheds to Increase Water Yield	Reinhart	Proc. of the Northeastern Weed Control Conference
6.	Oak Site Index on Belmont Limestone Soils in the Allegheny Mountains	Yawney	Res.Paper NE-30
7.	Improvement in Butt-log Grade with Increase in Tree Size, for Six Hardwood Species	Trimble	Res.Paper NE-31

MANUSCRIPTS SUBMITTED

			Recommended for
1.	Thirteen Million Pounds	Reinhart	Va. Forests
2.	A Cost Figure for One Type of Cleaning in Appalachian hardwoods	Trimble & Wendel	Research Note
3.	Aerial Spraying with 2,4,5-T of Poor Site Hardwoods in West Virginia	Wendel	Research Note
4.	Reducing the Proportion of Defective Material in Hardwood Stands	Trimble	Northern Logger

WHITE PINE PROJECT

Alfred, Maine

Semi-Annual Report, October 1965-March 1965

YOUNG WHITE PINE RESPOND TO RELEASE

Response of young white pine to release depends on density of initial stand and amount of release. Changes in growth rate were expected when a study of tree response was undertaken. Of greater interest, it was found that these changes can be seen at the end of the year in which they occur by taking measurements at intervals along the lower portion of the main stem of the trees. Relative changes in diameter from one year to the next and between release classes show how trees respond to changes in their environment. Changes in branch growth from one whorl to a higher one and between whorls at the same height in different release classes are the more sensitive measure of growth responses; but it takes longer to get these measurements.

Young white pine, dating from the 1947 seed crop, were used in the study. In one location, the N-Unit, trees were released from hardwood competition in 1954. White pine stocking was uneven. In the denser patches, there was an average of 4,800 stems per acre which were at least two-thirds as tall as the trees selected for release. There were other pine on the area growing entirely in the open: no other trees within 20 feet of them. In the other location, the S-Unit, white pine was released in 1957. Pine stocking here was more uniform and denser. Trees were selected in portions of the stand where stocking averaged 21,800 stems per acre. These figures are based on tallies made within a 4-foot radius of trees selected for release.

The following selections and treatments were made in the fall of 1962: 10 open-grown trees, N-Unit, no treatment; 10 trees released by cutting all stems within a 4-foot radius on both the N-Unit and the S-Unit (20 trees total); and 10 trees released on each Unit by cutting all stems within a 7-foot radius. The latter trees have about three times as much growing space as the former. Heights of selected trees were about the same. Average for each group of 10 trees ranged from 9' 4" to 10' 0" in 1962.

The point of particular interest is the fact that relative changes in growth can be measured at the end of the year in which they occur. Measurements at several points along the main stem are necessary since change is reflected in several ways, depending on initial stand density (tree vigor) and amount of release.

The other points brought out are generally understood and are of interest primarily because they can be demonstrated over such a short period of time in these stands:

(1) There is no measurable first year response to release (regardless of amount of release) when trees in dense stands are given more growing space: trees in dense stands cannot utilize very much space initially.

(2) In more open stands, there is an initial response to release and it is related to the amount of growing space provided.

(3) When severely crowded trees are released adequately, there is a marked response (after a year or so) which can be measured by the increased growth rate at the stump.

(4) When trees are released, there is also a response of added branch growth in the lower whorls; but this is not apt to extend to the lowest living whorls.

(5) On open-grown trees, branches in the lowest whorls grow slower from one year to the next; the more vigorous portion of the crown moves higher up the tree. This leads to an increase in main stem growth rate at higher points on the stem.

DIRECT SEEDING CHRISTMAS TREES

Christmas trees were successfully direct seeded in a recent trial in Maine at an approximate cost of $15.00 per acre. The seeding site, a runout hayfield, was prepared by plowing furrows at 6-foot intervals with an ordinary plow and farm tractor. Four to seven seeds were buried in seed spots 3' apart in the furrows. Species planted include Scotch pine (two seed sources), Austrian pine, white pine, red pine, jack pine, limber pine, Douglas fir, Fraser fir, and blue spruce.

Germination and first year survival were adequate for all species. However, the rapid invasion of the furrows by herbaceous plants and grasses may cause a serious problem during the second growing season. Some chemical control of the unwanted vegetation will be carried out.